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Vivid™ 3 Pro/Vivid™ 3 Service Manual

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- **ESTE MANUAL DE ASSISTÊNCIA TÉCNICA SÓ SE ENCONTRA DISPONÍVEL EM INGLÊS.**
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- **O NÃO CUMPRIMENTO DESTE AVISO PODE POR EM PERIGO A SEGURANÇA DO TÉCNICO, OPERADOR OU PACIENTE DEVIDO A‘ CHOQUES ELÉTRICOS, MECÂNICOS OU OUTROS.**

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1	April 2002	Second Release
2	November 2002	Third Release
3	September 2003	Fourth Release
4	December 2003	New Breakthrough
5	March 2004	Hardware Modifications; Corrections
6	July 2005	Updated System Labels; added Waste Electrical and Electronic Equipment (WEEE) Disposal warning
7	February 2006	Software Upgrade

List of Effected Pages

Pages	Revision	Pages	Revision	Pages	Revision
Title Page	N/A	Chapter 2 - Pre-Installation pages 2-1 to 2.12	7	Chapter 7 - Diagnostics/ Troubleshooting pages 7-1 to 7-130	7
Important Precautions pages i to iv	7	Chapter 3 - Installation pages 3-1 to 3-78	7	Chapter 8 - Replacement Procedures pages 8-1 to 8-190	7
Legal / Rev History/LOEP pages v to vi	7	Chapter 4 - Functional Checks pages 4-1 to 4-34	7	Chapter 9 - Replacement Parts pages 9-1 to 9-38	7
Table of Contents pages vii to xxii	7	Chapter 5 - Theory pages 5-1 to 5-52	7	Chapter 10 - Periodic Maintenance pages 10-1 to 10-32	7
Chapter 1 - Introduction pages 1-1 to 1-28	7	Chapter 6 - Service Adjustments pages 6-1 to 6-18	7	Back Cover	N/A

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Chapter 1 Introduction

Section 1-1 Overview

1-1-1 Purpose of Chapter 1

This chapter describes important issues related to safely servicing the Vivid™ 3 scanner. The service provider must read and understand all the information presented here before installing or servicing a unit.

Table 1-1 Contents in Chapter 1

Section	Description	Page Number
1-1	Overview	1-1
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1-1-2 Purpose of Service Manual

This manual provides installation and service information for the Vivid™ 3 ultrasound unit, and contains the following chapters:

- *Chapter 1 - Introduction:*
  Contains a content summary and warnings.
- *Chapter 2 - Pre-Installation*
  Contains pre-installation requirements for the Vivid™ 3 ultrasound unit.
- *Chapter 3 - Installation*
  Contains installation procedures and an installation checklist.
- *Chapter 4 - Functional Checks*
  Contains functional checks that are recommended as part of the installation procedure, or as required during servicing and periodic maintenance.
- *Chapter 5 - Components and Function (Theory)*
  Contains block diagrams and functional explanations of the electronic circuits.
- *Chapter 6 - Service Adjustments*
  Contains instructions for performing service adjustments to the Vivid™ 3 ultrasound unit.
- *Chapter 7 - Diagnostics/Troubleshooting*
  Provides instructions for setting up and running diagnostic, troubleshooting and other related routines for the Vivid™ 3 ultrasound unit.

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- *Chapter 8 - Replacement Procedures*
  Provides disassembly and reassembly procedures for all Field Replaceable Units (FRUs).
- *Chapter 9 - Renewal Parts*
  Contains a complete list of field replaceable parts for the Vivid™ 3 ultrasound unit.
- *Chapter 10 - Periodic Maintenance*
  Provides periodic maintenance procedures for the Vivid™ 3 ultrasound unit.

1-1-3 Typical Users of the Basic Service Manual

This manual is intended for the following categories of users:

- GE service personnel (installation, maintenance, etc.).
- Hospital service personnel.
- Contractors (some parts of Chapter 2 - Pre-Installation).

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1-1-4 Vivid™ 3 Models Covered in this Manual

The Vivid™ 3 models documented in this manual are shown in Table 1-2 and Table 1-3 below.

NOTE: The difference between the two types of Vivid™ 3 BTO3 models are as follows:
On RFI models (supported by software version 3.2, and above), Image Port, RFT, and FEC functionality are all incorporated into one board - the RFI board.
For RFT models (supported by software versions below 3.2), the Image Port, RFT, and FEC boards are all separate components.

Table 1-2 Vivid™ 3 - BT03 - RFI Models

Model	Cat No.	Description	Comments
BASE Vivid 3 Console			
Vivid 3 BT03 console, 220-240V AC, RFI	H45011GD	An advanced version of the newer generation of the Vivid™ 3 BT03 Ultrasound Scanning System. Enables a larger variety of probes and larger application use.	The BT03 is backward compatible to its parallel product, the BT02 Pro and Expert and its predecessor BT01 Pro and Expert. Contact your local distributor for more information about upgrades and backward compatibility. BT00 hardware cannot be upgraded to this level.
Vivid 3 BT03 console, 100V AC, RFI	H45011GE		
Vivid 3 BT03 console, 110-120V AC, RFI	H45011GF		
Vivid 3 BT03 console, 220-230V AC / NTSC, RFI	H45011GG		
Vivid 3 BT03 console, NTRL, RFI	H45521JB		
PRO Console			
Vivid 3 BT03 PRO console, 220-240V AC, RFI	H45011G	New generation of the Vivid™ 3 Ultrasound Scanning System, continuation of the product line of Vivid™ 3 BT01 & BT02. For global universal use.	The Pro is backward compatible to its predecessor, the BT01 & BT02. Contact your local distributor for more information about upgrades and backward compatibility. BT00 hardware cannot be upgraded to this level
Vivid 3 BT03 PRO console, 100V AC, RFI	H45011GA		
Vivid 3 BT03 PRO console, 110-120V AC, RFI	H45011GB		
Vivid 3 BT03 PRO console, 220V-230V AC / NTSC, RFI	H45011GC		
Vivid 3 BT03 PRO console, NTRL, RFI	H45521JA		

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Table 1-3 Vivid™ 3 - BT03 - RFT Models

Model	Cat No.	Description	Comments
BASE Vivid 3 Console			
Vivid 3 BT03 console, 220-240V AC	H45011ES	An advanced version of the newer generation of the Vivid™ 3 BT03 Ultrasound Scanning System. Enables a larger variety of probes and larger application use.	The BT03 is backward compatible to its parallel product, the BT02 Pro and Expert and its predecessor BT01 Pro and Expert. Contact your local distributor for more information about upgrades and backward compatibility. BT00 hardware cannot be upgraded to this level.
Vivid 3 BT03 console, 100V AC	H45011ET		
Vivid 3 BT03 console, 110-120V AC	H45011EU		
Vivid 3 BT03 console, 220-230V AC / NTSC	H45011EV		
Vivid 3 BT03 console, NTRL	H45521EW		
PRO Console			
Vivid 3 BT03 PRO console, 220-240V AC	H45011FD	New generation of the Vivid™ 3 Ultrasound Scanning System, continuation of the product line of Vivid™ 3 BT01 & BT02. For global universal use.	The Pro is backward compatible to its predecessor, the BT01 & BT02. Contact your local distributor for more information about upgrades and backward compatibility. BT00 hardware cannot be upgraded to this level
Vivid 3 BT03 PRO console, 100V AC	H45011FE		
Vivid 3 BT03 PRO console, 110-120V AC	H45011FF		
Vivid 3 BT03 PRO console, 220V-230V AC / NTSC	H45011FG		
Vivid 3 BT03 PRO console, NTRL	H45521FH		

NOTE: Vivid™ 3 systems with Serial No 5000 and above, have the RFI system hardware configuration. All systems with a serial number prior to this (i.e. 4999 and below) are configured with RFT hardware.

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1-1-5 System History - Hardware and Software Versions

The newest generation of the Vivid™ 3 (BT03) ultrasound unit is based on its predecessor, the Vivid™ 3 (BT01 and BT02) ultrasound unit, and is therefore backward compatible. The Vivid™ 3 ultrasound unit enables advanced features in a compact and user friendly tool.

Note: Vivid™ 3 (BT00) cannot be upgraded to the Vivid™ 3 Pro 03 as was the case for Pro 02.

The Vivid™ 3 Pro and Vivid™ 3 are the same generation of products, but differ in their functionality, enabling customers to receive some of the advanced Vivid™ 3 features. With minor software and hardware modifications, the Vivid™ 3 Pro can be upgraded to the Vivid™ 3 - refer to Table 1-4 .

Table 1-4 Vivid™ 3 Upgrade Options Available

Part No.	Upgrade	Comments
H45011BA	BT00 to BT00 Pro upgrade	
H45011BP	BT00 to BT00 Pro upgrade for P509 probe	
H45011BC	Platform upgrade from Vivid™ 3 BT01 "Pro" to "Expert"	
H45011DL	BT00 to Pro-02 upgrade	
H45011DM	BT00 Pro to Pro-02 upgrade	
H45011DR	BT01 Pro to Pro-02 upgrade	
H45011DS	BT01 Expert to Expert -02 upgrade	
H45011FB	BT01/BT02 Pro to BT03 Upgrade	New
H45011FC	BT01/BT02 Expert to BT03 Upgrade	New
H45011BN	3rd Probe Connector for Vivid 3 system field upgrade	New
H45011MK	17 " Monitor field upgrade	New

1-1-6 Purpose of Operator Manual(s)

The Operator Manual(s) should be fully read and understood before operating the Vivid™ 3 system, and also kept near the unit for quick reference.

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Section 1-2
Important Conventions

1-2-1 Conventions Used in this Manual

1-2-1-1 Model Designations

This manual covers the Vivid™ 3 ultrasound units listed in Table 1-2 on page 1-3 and Table 1-3 on page 1-4.

1-2-1-2 Icons

Pictures, or icons, are used wherever they will reinforce the printed message. The icons, labels and conventions used on the product and in the service information are described in this chapter.

1-2-1-3 Safety Precaution Messages

Various levels of safety precautions are found on the equipment and throughout this service manual. Different levels of severity are identified by one of the following icons which precede precautionary statements in the text.

DANGER: Indicates the presence of a hazard that will cause severe personal injury or death if the instructions are ignored.

WARNING: Indicates the presence of a hazard that can cause severe personal injury and property damage if the instructions are ignored.

CAUTION: Indicates the presence of a hazard that can cause property damage but has absolutely no personal injury risk.

Note: Notes are used to provide important information about an item or a procedure. Be sure to read the notes as the information they contain can often save you time or effort.

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1-2-1-4 Standard Hazard Icons

Important information will always be preceded by the exclamation point contained within a triangle, as seen throughout this chapter. In addition to text, several different graphical icons (symbols) may be used to make you aware of specific types of hazards that could cause harm.

Table 1-5 Standard Hazard Icons

ELECTRICAL	MECHANICAL	RADIATION

LASER	HEAT	PINCH

Other hazard icons make you aware of specific procedures that should be followed.

Table 1-6 Standard Icons Indicating a Special Procedure Be Used

AVOID STATIC ELECTRICITY	TAG AND LOCK OUT	WEAR EYE PROTECTION

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Section 1-3
Safety Considerations

1-3-1 Introduction

The following safety precautions must be observed during all phases of operation, service and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual, violates safety standards of design, manufacture and intended use of the equipment.

1-3-2 Human Safety

Operating personnel must not remove the system covers.
Servicing should be performed by authorized personnel only.
Only personnel who have participated in Vivid™ 3 Training are authorized to service the equipment.

1-3-3 Mechanical Safety

DANGER: WHEN THE UNIT IS RAISED FOR A REPAIR OR MOVED ALONG ANY INCLINE, USE EXTREME CAUTION SINCE IT MAY BECOME UNSTABLE AND TIP OVER.

DANGER: ULTRASOUND PROBES ARE HIGHLY SENSITIVE MEDICAL INSTRUMENTS THAT CAN EASILY BE DAMAGED BY IMPROPER HANDLING. USE CARE WHEN HANDLING AND PROTECT FROM DAMAGE WHEN NOT IN USE. DO NOT USE A DAMAGED OR DEFECTIVE PROBE. FAILURE TO FOLLOW THESE PRECAUTIONS CAN RESULT IN SERIOUS INJURY AND EQUIPMENT DAMAGE.

DANGER: NEVER USE A PROBE THAT HAS BEEN SUBJECTED TO MECHANICAL SHOCK OR IMPACT. EVEN IF THE PROBE APPEARS TO BE UNBROKEN, IT MAY IN FACT BE DAMAGED.

CAUTION: Always lower and center the Operator I/O Panel before moving the scanner.

CAUTION: The Vivid™ 3 weighs 160 kg (353 lbs.)or more, depending on installed peripherals, when ready for use. Care must be used when moving it or replacing its parts. Failure to follow the precautions listed could result in injury, uncontrolled motion and costly damage.

ALWAYS:

Be sure the pathway is clear.

Use slow, careful motions.

Use two people when moving the system on inclines or lifting more than 16 kg (35 lbs).:

WARNING: Always lock the control console in its parking (locked) position after moving the system. Failure to do so could result in personal injury or equipment damage.

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WARNING: Equipment damage could result if special care is not taken when transporting the system in a vehicle.

ALWAYS:

- **Secure the system in an upright position and lock the wheels (brake).**
- **DO NOT use the control console as an anchor point.**
- **Place the probes in their carrying case.**
- **Eject any disks from the MOD (if installed).**
- **Ensure that the system is well prepared and packed in its original packaging before transporting. Special care must be taken to correctly position the packing material supporting the monitor. For further information, refer to *Chapter 3 - Installation*.**

CAUTION: Keep the heat venting holes on the monitor unobstructed to avoid overheating of the monitor.

1-3-4 Electrical Safety

To minimize shock hazard, the equipment chassis must be connected to an electrical Ground. The system is equipped with a three-conductor AC power cable. This must be plugged into an approved electrical outlet with safety grounding.

The power outlet used for this equipment should not be shared with other types of equipment. Both the system power cable and the power connector must meet international electrical standards.

1-3-4-1 Probes

All the probes for the Vivid™ 3 ultrasound unit are designed and manufactured to provide trouble-free, reliable service. To ensure this, correct handling of probes is important and the following points should be noted:

- Do not drop a probe or strike it against a hard surface, as this may damage the transducer elements, acoustic lens, or housing.
- Do not use a cracked or damaged probe. In this event, call your field service representative immediately to obtain a replacement.
- Avoid pulling, pinching or kinking the probe cable, since a damaged cable may compromise the electrical safety of the probe.
- To avoid the risk of a probe accidentally falling, do not allow the probe cables to become entangled, or to be caught in the machine's wheels.

NOTE: For detailed information on handling endocavity probes, refer to the appropriate supplementary instructions for each probe. In addition, refer to the Vivid™ 3 Pro/Vivid™ 3 Expert User Manual for detailed probe handling instructions.

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1-3-5 Dangerous Procedure Warnings

Warnings, such as the examples below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

DANGEROUS VOLTAGES, CAPABLE OF CAUSING DEATH, ARE PRESENT IN THIS EQUIPMENT. USE EXTREME CAUTION WHEN HANDLING, TESTING AND ADJUSTING.

EXPLOSION WARNING

DO NOT OPERATE THE EQUIPMENT IN AN EXPLOSIVE ATMOSPHERE.

OPERATION OF ANY ELECTRICAL EQUIPMENT IN SUCH AN ENVIRONMENT CONSTITUTES A DEFINITE SAFETY HAZARD.

DO NOT SUBSTITUTE PARTS OR MODIFY EQUIPMENT

BECAUSE OF THE DANGER OF INTRODUCING ADDITIONAL HAZARDS, DO NOT INSTALL SUBSTITUTE PARTS OR PERFORM ANY UNAUTHORIZED MODIFICATION OF THE EQUIPMENT.

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Section 1-4
Product Labels and Icons

The Vivid™ 3 ultrasound unit comes equipped with product labels and icons. These labels and icons represent pertinent information regarding the operation of the ultrasound unit.

1-4-1 Product Label Locations

The following two diagrams indicate the location of some of the labels and icons found on the Vivid™ 3 ultrasound units. All the labels and icons are described in Table 1-7 on page 1-13.

Figure 1-1 Product Label and Icon Locations (Front)

1 Product Logo

2 Equipment Type CF

3 Parking Label on Brake Pedal

4 Class II Equipment

5 Swivel Brake Label on Brake Pedal

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Figure 1-2 Product Label and Icon Locations (Rear)

1 Main Label

2 AC Voltage Rating Label

3 GND Label

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1-4-2 Label Descriptions

The following table shows the labels and symbols that may be found on the Vivid™ 3 ultrasound unit, and provides a description of each label's purpose and location.

Table 1-7 Product Icons

Label Name	Description	Location
Product Logo	Identifies **Vivid™ 3** models.	Front of the unit.
Identification and Rating Plate	Manufacturer's name and address. Date of Manufacture. Model and Serial numbers. Electrical ratings.	Rear of the unit, near the power inlet.
	Class I Equipment, in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in that means are provided for the connection of the equipment to the protective earth conductor in the fixed wiring of the installation - in such a way that accessible metal parts cannot become *live* in the event of a failure of the basic insulation.	Rear of the unit and probe connectors.
Device Listing/Certification Labels	Laboratory logos or labels that denote conformity with industry safety standards, such as UL or IEC.	Rear of the unit.
	CE certification mark.	Rear of the unit, on the main label.
	Equipment Type BF (man in the box symbol) IEC 878-02-03 indicates B Type equipment having even more electrical isolation than standard Type B equipment because it is intended for intimate patient contact.	Probe connectors PCG connector or Rear of Console
	Equipment Type CF IEC 878-02-05 indicates equipment having a floating applied part that provides a degree of protection suitable for direct cardiac contact.	Front of the unit, ECG connector and surgical probes.
CAUTION - This machine weighs...Special care must be used to avoid..." 	This precaution is intended to prevent injury that may be caused by the weight of the machine if one person attempts to move it considerable distances or on an incline.	Used in the Service and User Manual which should be adjacent to equipment at all times for quick reference.

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Table 1-7 Product Icons (Continued)

Label Name	Description	Location
"DANGER - Risk of explosion used in..."	The system is not designed for use with flammable anesthetic gases.	Indicated in the Service Manual.
	"CAUTION" The equilateral triangle is usually used in combination with other symbols to advise or warn the user.	Rear of the unit.
	“ATTENTION - Consult accompanying documents” is intended to alert the user to refer to the User Manual or other instructions when complete information cannot be provided on the label.	Rear of the unit.
	"CAUTION - Dangerous voltage" (the lightning flash with arrowhead in equilateral triangle) is used to indicate electric shock hazards.	Rear of the unit.
	"Protective Earth" Indicates the protective earth (grounding) terminal.	Rear of the unit.
	"Equipotentiality" Indicates the terminal to be used for connecting equipotential conductors when interconnecting (grounding) with other equipment.	Peripherals
	Waste Electrical and Electronic Equipment (WEEE) Disposal This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.	Rear of the unit.

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1-4-3 Vivid™ 3 External Labels

In addition to the labels described in the previous section, additional labels may be found on the Vivid™ 3 ultrasound unit, as described in the following sections:

- *Main Label* section, on page 1-15.
- *Rating Labels* section, on page 1-23.
- *GND Label* section, on page 1-24.
- *Parking Label* section, on page 1-24.
- *Swivel Brake Label* section, on page 1-24.

1-4-3-1 Main Label

The main label may be printed in any of the following languages: *English*, *German*, *French*, *Spanish*, *Portuguese*, *Italian*, *Chinese*, *Danish*, *Dutch*, *Finnish*, *Greek*, *Japanese*, *Norwegian*, *Russian*, or *Swedish*, as shown in the examples below. Each main label includes a serial number, a voltage rating, caution warnings, danger warnings and classifications (UL, CE0344 and so on.)

- **English:** Used for all countries except those in which German, French, Spanish, Portuguese or Italian are spoken.

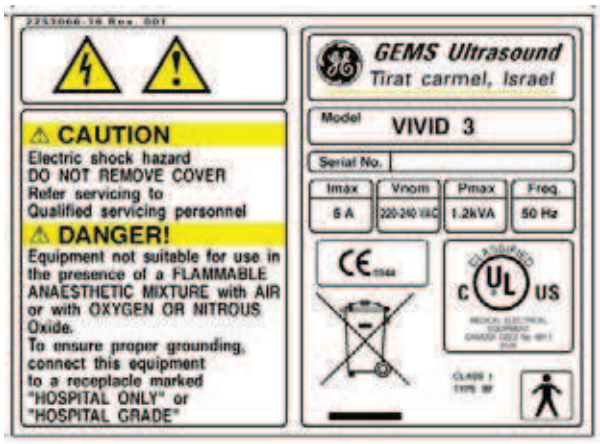
GEMS Ultrasound
Tirat carmel, Israel
Model VIVID 3
Serial No.
Imax Vnom Pmax Freq.
6 A 220-240 VAC 1.2kVA 50 Hz
CAUTION
Electric shock hazard
DO NOT REMOVE COVER
Refer servicing to
Qualified servicing personnel
DANGER!
Equipment not suitable for use in the presence of a FLAMMABLE ANAESTHETIC MIXTURE with AIR or with OXYGEN OR NITROUS Oxide.
To ensure proper grounding, connect this equipment to a receptacle marked "HOSPITAL ONLY" or "HOSPITAL GRADE"

Figure 1-3 Main Label (English) 220 -240V

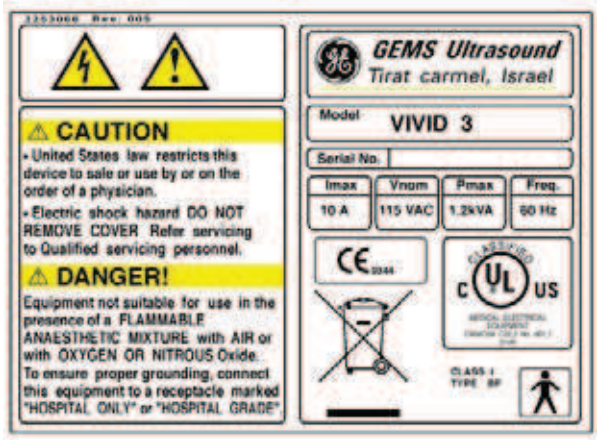
GEMS Ultrasound
Tirat carmel, Israel
Model VIVID 3
Serial No.
Imax Vnom Pmax Freq.
10 A 115 VAC 1.2kVA 60 Hz
CAUTION
• United States law restricts this device to sale or use by or on the order of a physician.
• Electric shock hazard DO NOT REMOVE COVER Refer servicing to Qualified servicing personnel.
DANGER!
Equipment not suitable for use in the presence of a FLAMMABLE ANAESTHETIC MIXTURE with AIR or with OXYGEN OR NITROUS Oxide.
To ensure proper grounding, connect this equipment to a receptacle marked "HOSPITAL ONLY" or "HOSPITAL GRADE"

Figure 1-4 Main Label (English) USA

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- **German:** Used in all German language countries.

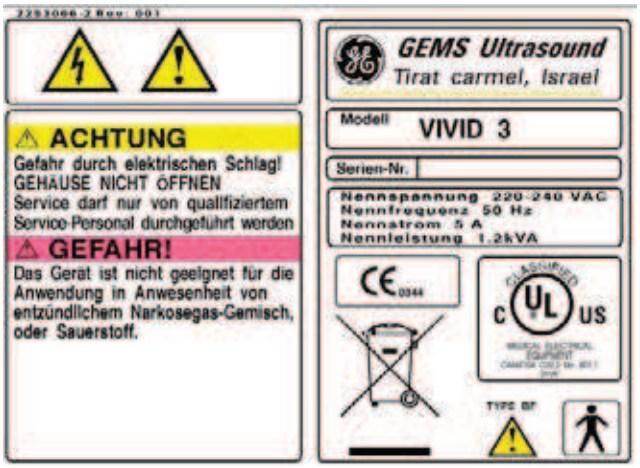

Figure 1-5 Main Label (German)

- **French:** Used in all French language countries.

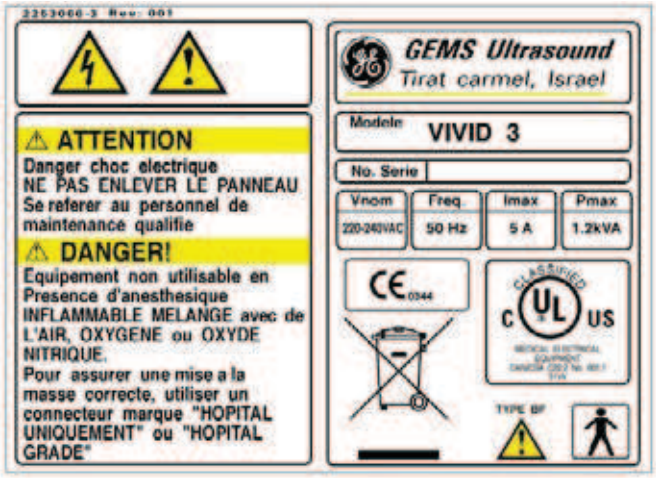
ATTENTION
Danger choc electrique
NE PAS ENLEVER LE PANNEAU
Se referer au personnel de maintenance qualifie
DANGER!
Equipement non utilisable en Presence d'anesthesique INFLAMMABLE MELANGE avec de L'AIR, OXYGENE ou OXYDE NITRIQUE.
Pour assurer une mise a la masse correcte, utiliser un connecteur marque "HOPITAL UNIQUEMENT" ou "HOPITAL GRADE"
GEMS Ultrasound
Tirat carmel, Israel
Modele VIVID 3
No. Serie
Vnom Freq. Imax Pmax
220-240VAC 50 Hz 5 A 1.2kVA
TYPE BF

Figure 1-6 Main Label (French)

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- **Spanish:** Used in all Spanish language countries.

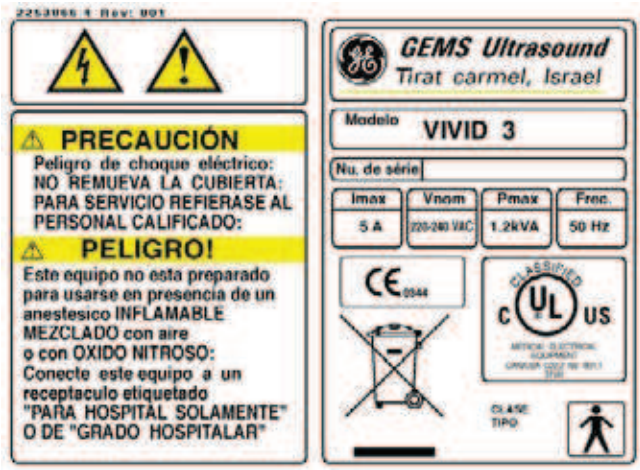

Figure 1-7 Main Label (Spanish)

- **Portuguese:** Used in all Portuguese language countries.

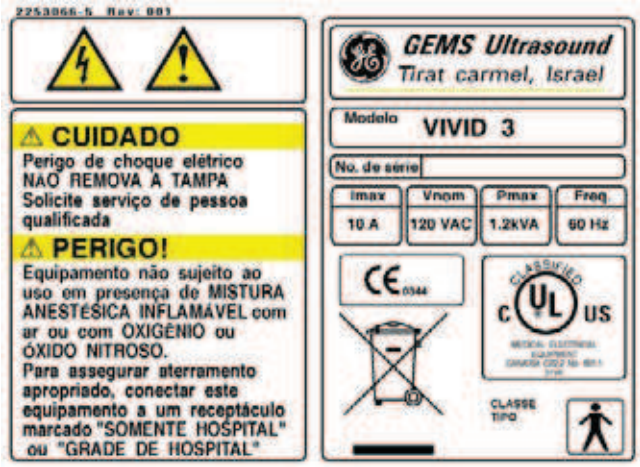

Figure 1-8 Main Label (Portuguese)

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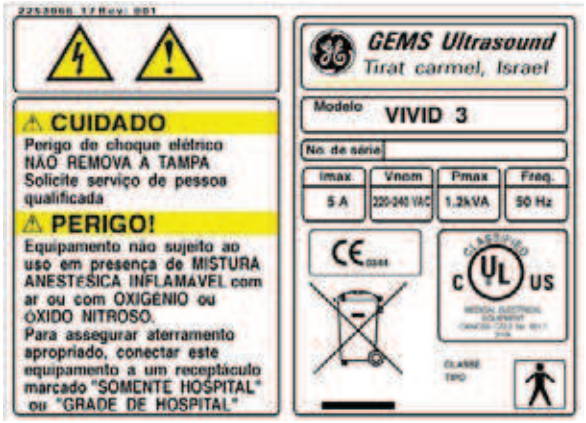

Figure 1-9 Main Label (Portuguese) 220 - 240V

- **Italian:** Used in all Italian language countries.

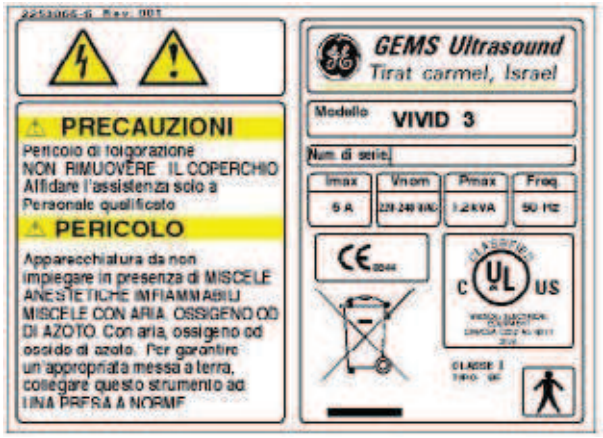

Figure 1-10 Main Label (Italian)

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- **Chinese:** Used in all Chinese language countries.

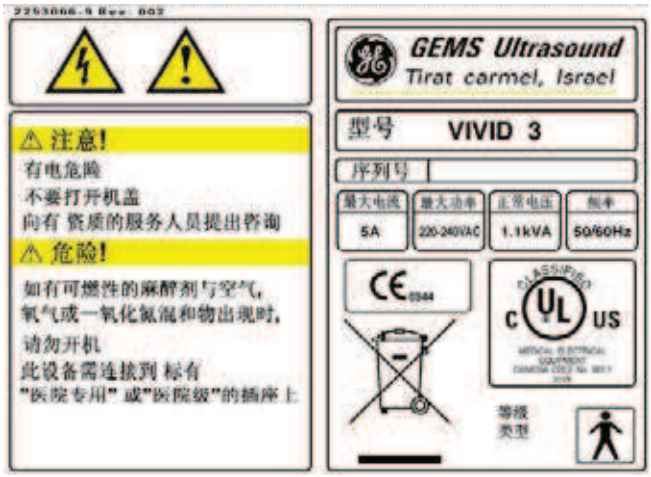

Figure 1-11 Main Label (Chinese)

- **Danish:** Used in all Danish language countries.

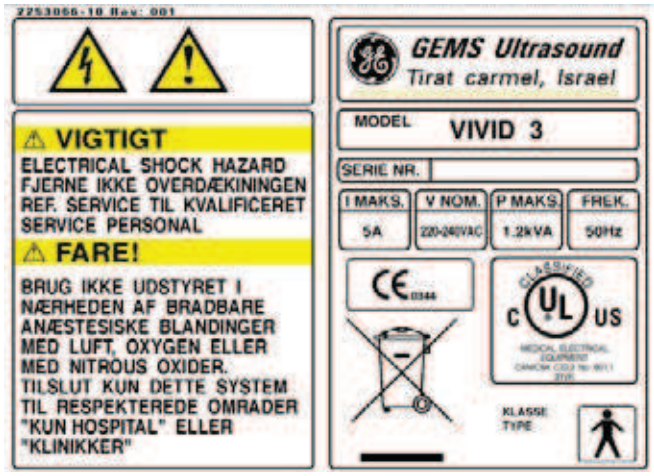

Figure 1-12 Main Label (Danish)

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- **Dutch:** Used in all Dutch language countries.

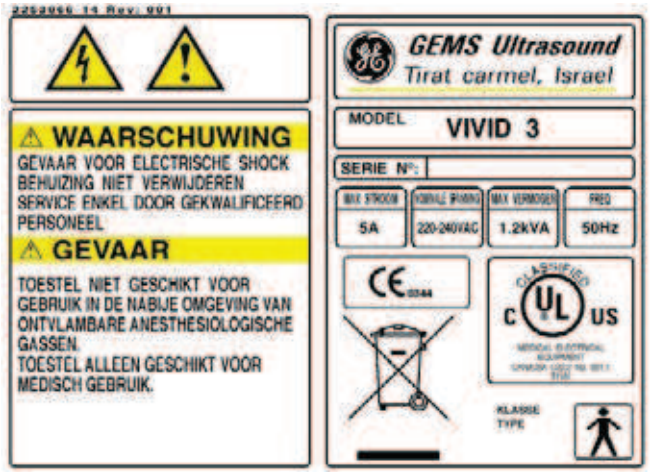

Figure 1-13 Main Label (Dutch)

- **Finnish:** Used in all Finnish language countries.

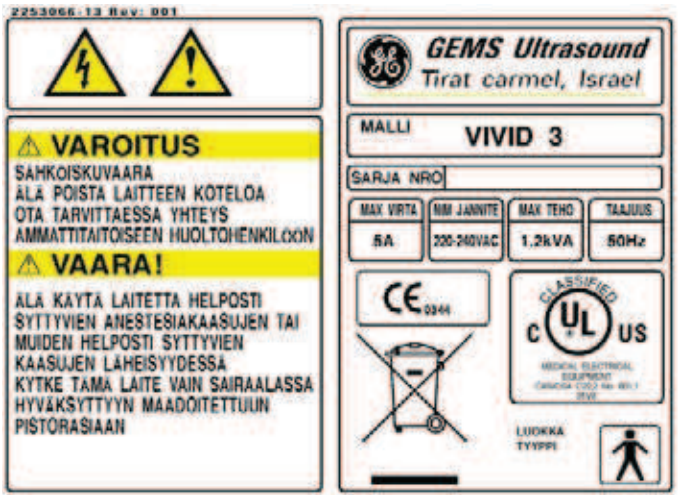

Figure 1-14 Main Label (Finnish)

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- **Greek:** Used in all Greek language countries.

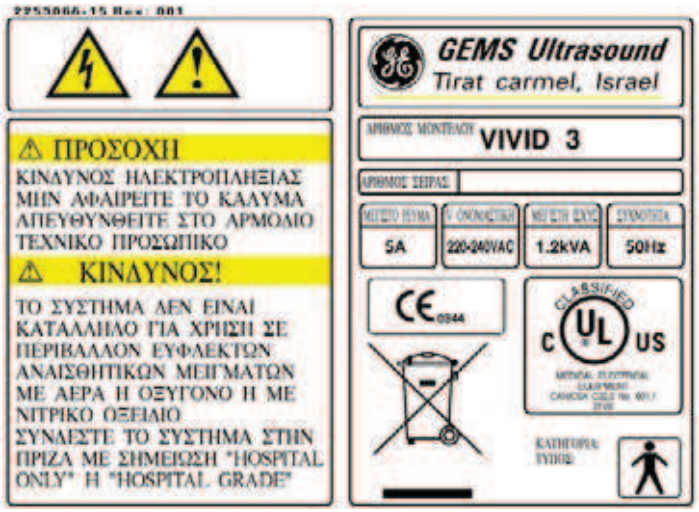

Figure 1-15 Main Label (Greek)

- **Japanese:** Used in all Japanese language countries.

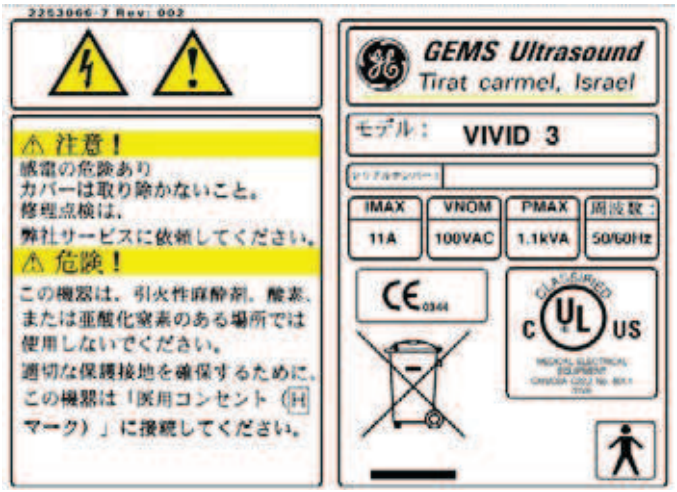

Figure 1-16 Main Label (Japanese)

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- **Norwegian:** Used in all Norwegian language countries.

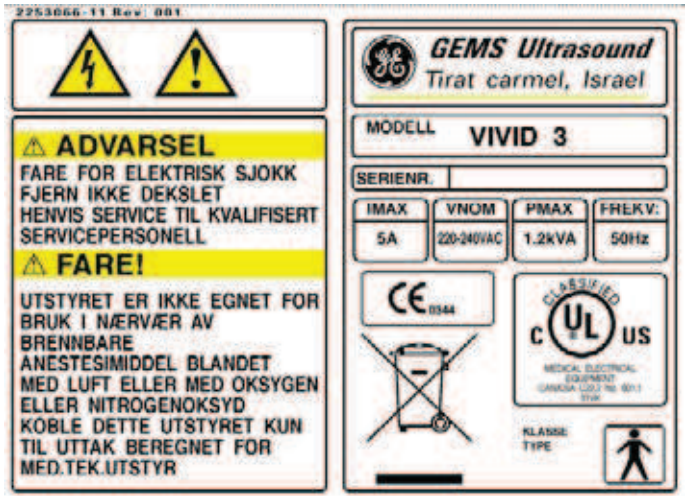

Figure 1-17 Main Label (Norwegian)

- **Russian:** Used in all Russian language countries.

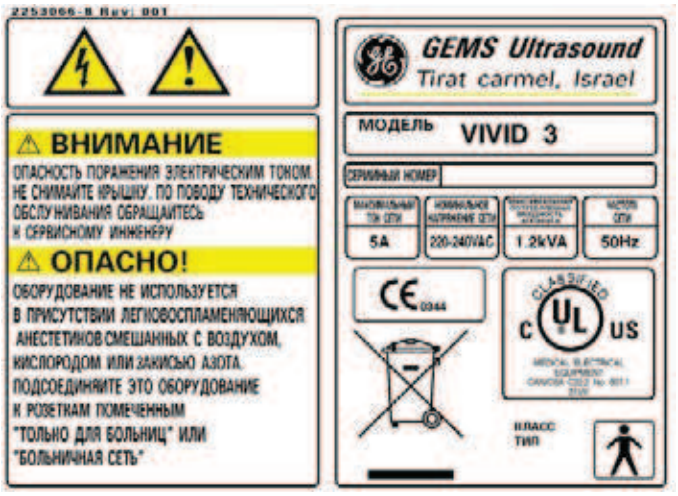

Figure 1-18 Main Label (Russian)

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- **Swedish:** Used in all Swedish language countries.

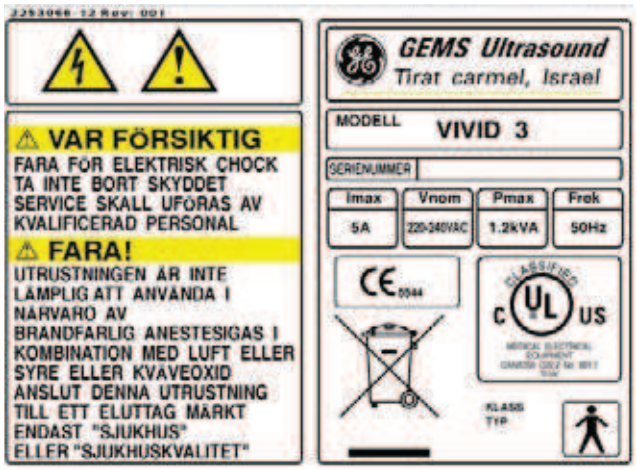

Figure 1-19 Main Label (Swedish)

1-4-3-2 Rating Labels

Indicates the ultrasound unit's factory preset input AC voltage as follows:

- AC 100V
- AC 120V
- AC 220-240V

One of the rating labels shown below is located on the rear of the ultrasound unit, as shown in Figure 1-2 on page 1-12.

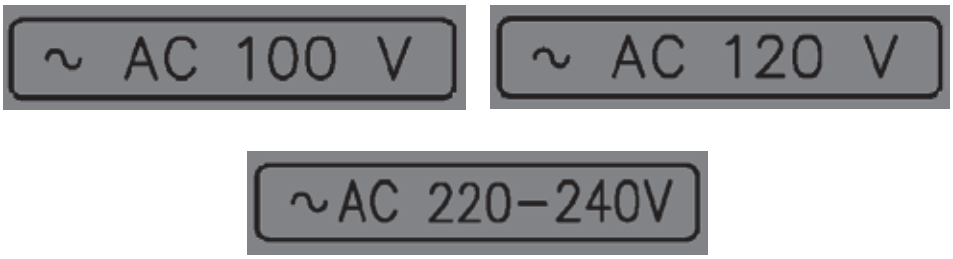

Figure 1-20 Rating Labels

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1-4-3-3 GND Label

Indicates the protective earth (grounding) terminal. The GND label shown below is located at the rear of the unit, as shown in Figure 1-2 on page 1-12.

Figure 1-21 GND Label

1-4-3-4 Parking Label

Indicates the locked pedal position which locks the front castors and prevents the ultrasound unit from moving. The parking label, shown below, is located on the brake pedal at the front of the unit, as shown in Figure 1-1 on page 1-11.

Figure 1-22 Parking Label

1-4-3-5 Swivel Brake Label

Indicates the locked swivel position which prevents the front castors from swiveling. The swivel brake label, shown below, is located on the brake pedal at the front of the unit, as shown in Figure 1-1 on page 1-11.

Figure 1-23 Swivel Break Label

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Section 1-5
EMC, EMI, and ESD

1-5-1 Electromagnetic Compatibility (EMC)

Electromagnetic compatibility describes a level of performance of a device within its electromagnetic environment. This environment consists of the device itself and its surroundings, including other equipment, power sources and persons with which the device must interface. Inadequate compatibility results when a susceptible device fails to perform as intended due to interference from its environment, or when the device produces unacceptable levels of emission. This interference is often referred to as radio–frequency or electromagnetic interference (RFI/EMI) and can be radiated through space or conducted over interconnecting power or signal cables. In addition to electromagnetic energy, EMC also includes possible effects from electrical fields, magnetic fields, electrostatic discharge and disturbances in the electrical power supply.

1-5-2 Electrostatic Discharge (ESD) Prevention

CAUTION: DO NOT TOUCH ANY BOARDS WITH INTEGRATED CIRCUITS PRIOR TO TAKING THE NECESSARY ESD PRECAUTIONS:

1.ALWAYS CONNECT YOURSELF, VIA AN ARM-WRIST STRAP, TO THE ADVISED ESD CONNECTION POINT LOCATED ON THE REAR OF THE SCANNER (TO THE RIGHT OF THE POWER CONNECTOR).

2.FOLLOW GENERAL GUIDELINES FOR HANDLING OF ELECTROSTATIC SENSITIVE EQUIPMENT.

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1-5-3 Standards Used

To fulfill the requirements of relevant EC directives and/or European Harmonized/International standards, the following documents/standards have been used:

Table 1-8 Standards Used

Standard/Directive	Scope
89/336/EEC	EMC Directive.
93/42/EEC	Medical Device Directive.
IEC 801-2	Electrostatic Discharge.
IEC 801-3	Radiated Electromagnetic Field.
IEC 801-4	Electrical Fast Transient/Burst.
IEC 805-1	Surge.
EN 55011/CISPR 11	Electromagnetic Susceptibility.
EN 60601-1/IEC 601-1/UL 2601-1	Medical Electrical Equipment; General Requirements for Safety.
EN 61157/ IEC 61157	Requirements for the declaration of the acoustic output of medical diagnostic ultrasonic equipment.

NOTE: For CE Compliance, it is critical that all covers, screws, shielding, gaskets, mesh and clamps are in good condition and installed tightly without skew or stress. Proper installation following all comments noted in this service manual is required in order to achieve full EMC performance.

1-5-4 Lockout/Tagout Requirements (For USA Only)

Follow OSHA Lockout/Tagout requirements by ensuring you are in total control of the electrical Mains plug.

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Section 1-6
Customer Assistance

1-6-1 Contact Information

If this equipment does not work as indicated in this service manual or in the *Vivid™ 3 Pro/Vivid™ 3 Expert User Manual*, or if you require additional assistance, please contact the local distributor or appropriate support resource, as listed below.

Prepare the following information before you call:

- System ID and/or serial number.
- Software version.

Table 1-9 GE Contact Information

Location	Phone Number
USA/ Canada GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 Customer Answer Center	Phone: +1-800-437-1171 Phone: +1-800-321-7937 Phone: +1-800-682-5327 Phone: +1-262-524-5698 Fax: +1-414-647-4125
Latin America GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 Customer Answer Center	Phone: +1-262-524-5300 Phone: +1-262-524-5698 Fax: +1-414-647-4125
Europe GE Ultraschall Deutschland GmbH& Co. KG BeethovenstraBe 239 Postfach 11 05 60, D-42665 Solingen Germany	General Imaging: +49 (212) 2802 207 Cardiac: +49 (212) 2802 208 Fax: +49 212 2802 431
Asia (Singapore/ Japan) GE Ultrasound Asia Service Department - Ultrasound 298 Tiong Bahru Road #15-01/06 Central Plaza Singapore 169730	Phone: +65-277-3487 Fax: +65-272-3997 Phone: +81-426-48-2950 Fax: +81-426-48-2902

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Chapter 2
Pre-Installation

Section 2-1
Overview

2-1-1 Purpose of Chapter 2

This chapter provides the information required to plan and prepare for the installation of a Vivid™ 3 ultrasound unit. Included are descriptions of the electrical and facility requirements that must be met by the purchaser. A worksheet is provided at the end of this chapter (see Figure 2-2 on page 2-11) to help ensure that all the required network information is available, prior to installation.

Table 2-1 Contents in Chapter 2

Section	Description	Page Number
2-1	Overview	2-1
2-2	Console Requirements	2-2
2-3	Facility Needs	2-7

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Section 2-2
Console Requirements

2-2-1 Unit Environmental Requirements

Table 2-2 Environmental Requirements

Requirement	Temperature	Relative Humidity (non-condensing)	Air Pressure
Operational	10 — 40°C (50 — 104°F)	50 — 70%	700 — 1060 hPa
Storage	-20 — 60°C (-4 — 140°F)	10 — 95%	700 — 1060 hPa
Transport	-20 — 60°C (-4 — 140°F)	10 — 95%	700— 1060 hPa

CAUTION: If the system has been in storage or has been transported, please see the acclimation requirements *before* powering ON and/or using the system. Refer to the *Installation Warnings* section on page 3-2.

2-2-2 Cooling Requirements

The cooling requirement for the Vivid™ 3 ultrasound unit environment is 3500 BTU/hr. This figure does not include the cooling required for lights, people, or other equipment in the room.

Note: Each person in the room places an additional 300 BTU/hr demand on the environmental cooling.

2-2-3 Lighting Requirements

For system installation, updates and repairs, bright lighting is required. However, operator and patient comfort may be optimized if the room lighting is subdued and indirect when a scan is being performed. Therefore, a combination lighting system (dim/bright) is recommended. Keep in mind that lighting controls and dimmers can be a source of EMI which could degrade image quality. These controls should be selected to minimize possible interference.

2-2-4 Time and Manpower Requirements

Site preparation takes time. Begin pre-installation checks as soon as possible to allow sufficient time to make any required changes. If possible, begin these checks as many as six weeks before system delivery.

CAUTION: At least two people must be available to deliver and unpack the Vivid™ 3 ultrasound unit. Attempts to move the unit considerable distances (or on an incline) by one person alone, could result in personal injury, and/or damage to the system.

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2-2-5 Electrical Requirements

NOTE: GE Medical Systems requires a dedicated power and Ground for the proper operation of its Ultrasound equipment. This dedicated power shall originate at the last distribution panel before the system.

Sites with a mains power system with defined Neutral and Live:

The dedicated line shall consist of one phase, a neutral (not shared with any other circuit), and a full size Ground wire from the distribution panel to the Ultrasound outlet.

Sites with a mains power system without a defined Neutral:

The dedicated line shall consist of one phase (two lines), not shared with any other circuit, and a full size Ground wire from the distribution panel to the Ultrasound outlet.

NOTE: Please note that image artifacts can occur, if at any time within the facility, the Ground from the main facility's incoming power source to the Ultrasound unit is only a conduit.

2-2-5-1 Vivid™ 3 Power Requirements

Electrical specifications for the Vivid™ 3 monitor and onboard peripherals are as follows:

Table 2-3 Electrical Requirements

Voltage	Tolerances	Op. Current	Frequency
100V AC	±10%	8A	50-60 Hz
120V AC	±10%	8A	50-60 Hz
220 - 240V AC	±10%	4A	50-60 Hz

2-2-5-2 Inrush Current

Inrush current is not a factor for consideration, due to the inrush current limiting properties of the power supplies.

Maximum power requirement = 1.2 KVa

- 100V AC: 8A
- 120V AC: 8A
- 220 - 240V AC: 4A

2-2-5-3 Site Circuit Breaker

It is recommended that the branch circuit breaker for the machine be readily accessible.

CAUTION POWER OUTAGE MAY OCCUR.

The Vivid 3 requires a dedicated single branch circuit. To avoid circuit overload and possible loss of critical care equipment, make sure you DO NOT have any other equipment operating on the same circuit.

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2-2-5-4 Site Power Outlets

A dedicated AC power outlet must be within reach of the unit without requiring the use of extension cords. Other outlets adequate for the external peripherals, medical and test equipment required to support this unit must also be present and located within 1 m (3.2 ft) of the unit. Electrical installation must meet all current local, state, and national electrical codes.

2-2-5-5 Mains Power Plug

If the unit arrives without a power plug, or with the wrong plug, contact your GE dealer. When necessary, the installation engineer will supply the locally-required power plug.

2-2-5-6 Power Stability Requirements

Voltage drop-out

Max 10 ms.

NOTE: The Vivid™ 3 ultrasound unit can be provided with an external UPS system. Contact your local GE Service Representative for details.

Power Transients

(All applications)

Less than 25% of nominal peak voltage for less than 1 millisecond for any type of transient, including line frequency, synchronous, asynchronous, or aperiodic transients.

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2-2-6 EMI Limitations

Ultrasound machines are susceptible to Electromagnetic Interference (EMI) from radio frequencies, magnetic fields, and transients in the air or wiring. They also generate EMI. The Vivid™ 3 ultrasound unit complies with limits as stated on the EMC label. However, there is no guarantee that interference will not occur in a particular installation.

Note: Possible EMI sources should be identified before the unit is installed, and should not be on the same line as the ultrasound system. A dedicated line should be used for the ultrasound system.

Electrical and electronic equipment may produce EMI unintentionally as the result of a defect. Sources of EMI include the following:

- Medical lasers.
- Scanners.
- Cauterizing guns.
- Computers.
- Monitors.
- Fans.
- Gel warmers.
- Microwave ovens.
- Portable phones.
- Broadcast stations and mobile broadcasting machines.

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The following table lists recommendations for preventing EMI:

Table 2-4 EMI Prevention/ Abatement

EMI Rule	Details
Ground the unit.	Poor grounding is the most likely reason an ultrasound unit will have noisy images. Check the grounding of the power cord and power outlet.
Be aware of RF sources.	Keep the unit at least 5m (16.4 ft) away from other EMI sources. Special shielding may be required to eliminate interference problems caused by high frequency, high powered radio or video broadcast signals.
Replace and/or reassemble all screws, RF gaskets, covers and cores.	After you finish repairing or updating the system, replace all covers and tighten all screws. Any cable with an external connection requires a magnet wrap at each end. Install the shield over the front of the card cage. Loose or missing covers or RF gaskets allow radio frequencies to interfere with the ultrasound signals.
Replace broken RF gaskets.	If more than 20% or a pair of the fingers on an RF gasket are broken, replace the gasket. Do not turn ON the unit until any loose metallic part is removed and replaced, if required.
Do not place labels where RF gaskets touch metal.	Never place a label where RF gaskets meet the unit. Otherwise, the gap created will permit RF leakage. In case a label has been found in such a location, move the label to a different, appropriate location.
Use GE specified harnesses and peripherals.	The interconnect cables are grounded and require ferrite beads and other shielding. Cable length, material, and routing are all important; do not make any changes that do not meet all specifications.
Take care with cellular phones.	Cellular phones may transmit a 5 V/m signal that causes image artifacts.
Properly address peripheral cables.	Do not allow cables to lie across the top of the card cage or hang out of the peripheral bays. Loop any peripheral cable excess length inside the peripheral bays or hang on the hooks provided below the console. Attach the monitor cables to the frame.

2-2-7 Probe Environmental Requirements

Table 2-5 Probe Operation and Storage Temperatures

	Electronics	PAMPTE
Operation	10 — 40°C (50 — 104°F)	5 — 42.7°C (41 — 109°F)
Storage	-20 — 50°C (-4 — 122°F)	-20 — 50°C (-4 — 122°F)

Note: System and electronic probes are designed for storage temperatures of -20° to +50° C. When exposed to large temperature variations, the probes should be kept at room temperature for a *minimum* of ***10 hours*** before use.

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Section 2-3
Facility Needs

2-3-1 Purchaser Responsibilities

The work and materials required to prepare the site are the responsibility of the purchaser. To avoid delay, complete all pre-installation work before delivery. Use the Pre-installation Check List (provided in Table 2-6 on page 2-12) to verify that all the required steps have been completed.

Purchaser responsibilities include:

- Procuring the required materials.
- Completing the preparations prior to delivery of the ultrasound system.
- Paying the costs of any alterations and modifications not specifically provided for in the sales contract.

Note: All relevant preliminary electrical installations at the prepared site must be performed by licensed electrical contractors. Other connections between electrical equipment, and calibration and testing, must also be performed by qualified personnel. The products involved (and the accompanying electrical installations) are highly sophisticated and special engineering competence is required. All electrical work on these products must comply with the requirements of applicable electrical codes. The purchaser of GE equipment must utilize only qualified personnel to perform electrical servicing of the equipment.

To avoid delays during installation, the individual or team who will perform the installation should be notified at the earliest possible date (preferably prior to installation), of the existence of any of the following variances:

- Use of any non-listed product(s).
- Use of any customer provided product(s).
- Placement of an approved product further from the system than the interface kit allows.

The prepared site must be clean prior to delivery of the system. Carpeting is not recommended because it collects dust and creates static. Potential sources of EMI should also be investigated before delivery. Dirt, static, and EMI can negatively impact system reliability.

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2-3-2 Mandatory Site Requirements

The following are mandatory site requirements. Additional (optional) recommendations, as well as a recommended ultrasound room layout, are provided in section *2-3-3 - Site Recommendations* (see below).

- A dedicated single branch power outlet of adequate amperage (see Table 2-3 on page 2-3.) that meets all local and national codes and is located less than 2.5 m (8.2 ft) from the unit's proposed location. Refer to the *Electrical Requirements* section on page 2-3.
- A door opening of at least 76 cm (2.5 ft) in width.
- The proposed location for the unit is at least 0.3 m (1 ft) from the walls, to enable cooling.
- Power outlets for other medical equipment and gel warmer.
- Power outlets for test equipment within 1 m (3.3 ft) of the ultrasound unit.
- Clean and protected space for storage of probes (either in their case or on a rack).
- Material to safely clean probes.
- In the case of a network option:
  - An active network outlet in the vicinity of the ultrasound unit.
  - A network cable of appropriate length (regular Pin-to-Pin network cable).
  - An IT administrator who will assist in configuring the unit to work with your local network. A fixed IP address is required. Refer to the form provided in Figure 2-2 on page 2-11 for network details that are required.

Note: All relevant preliminary network outlets installations at the prepared site must be performed by authorized contractors. The purchaser of GE equipment must utilize only qualified personnel to perform servicing of the equipment.

2-3-3 Site Recommendations

The following are (optional) site recommendations. Mandatory site requirements are provided in the *Mandatory Site Requirements* section, above.

- A door opening of 92 cm (3 ft) in width.
- An accessible circuit breaker for a dedicated power outlet.
- A sink with hot and cold running water.
- A receptacle for bio–hazardous waste, for example, used probe sheaths.
- An emergency oxygen supply.
- A storage area for linens and equipment.
- A nearby waiting room, lavatory, and dressing room.
- Dual level lighting (bright and dim).
- A lockable cabinet for software and manuals.

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2-3-3-1 Recommended Ultrasound Room Layout

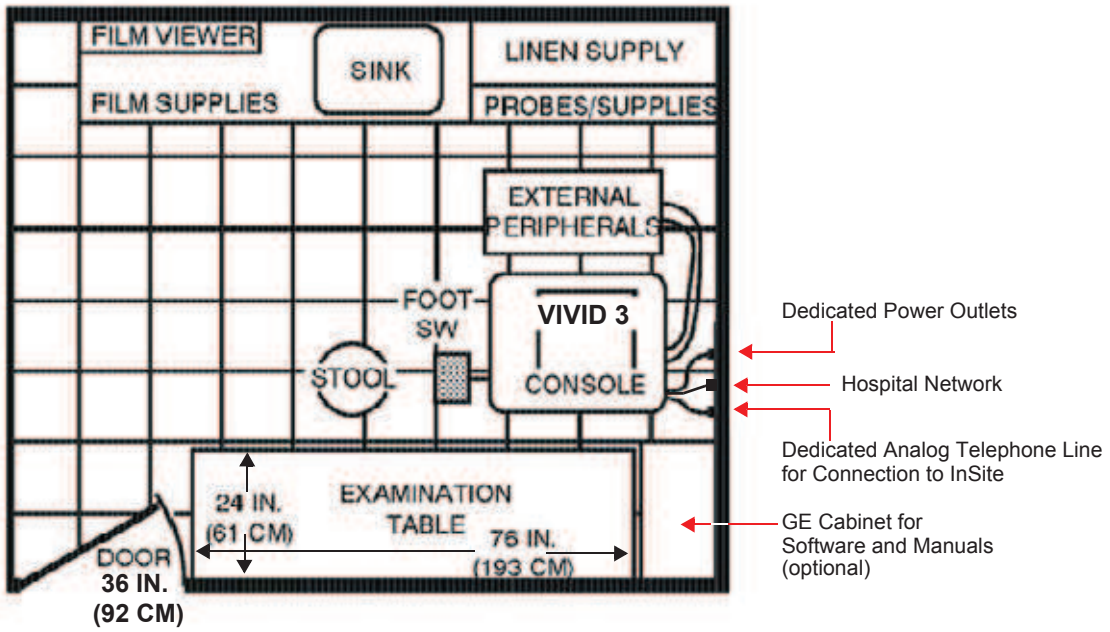

Figure 2-1 Minimal Floor Plan 2.5m x 3m (8.2ft x 9.84 ft)

2-3-4 Networking Pre-Installation Requirements

2-3-4-1 Stand-alone Unit (without Network Connection)

None.

2-3-4-2 Unit Connected to Hospital's Network

Supported networks:

- 100/10 Mbit/sec

2-3-4-3 Purpose of the DICOM Network Function

DICOM services provide the operator with clinically useful features for moving images and patient information over a hospital network. Examples of DICOM services include the transfer of images to workstations for viewing or transferring images to remote printers. As an added benefit, transferring images in this manner frees up the on-board monitor and peripherals, enabling viewing to be done while scanning continues. With DICOM, images can be archived, stored, and retrieved faster, easier, and at a lower cost.

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2-3-4-4 DICOM Option Pre-Installation Requirements

To configure the Vivid™ 3 ultrasound unit to work with other network connections, the network administrator must provide the required information, which should include the following:

- **Vivid™ 3 Details**: DICOM network details for the Vivid™ 3 unit, including the host name, local port, IP address, AE title and net mask.
- **Routing Information**: IP addresses for the default gateway and other routers in use at the site.
- **DICOM Application Information**: Details of the DICOM devices in use at the site, including the DICOM host name, AE title and IP addresses.

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Section 2-4
Connectivity Installation Worksheet

Site System Information

Site:
Dept:
Vivid™ 3 SN:
Type:
Floor:
Room:
REV:
Comments:

CONTACT INFORMATION

Name	Title	Phone	E-Mail Address

TCP/IP Settings

Scanner IP Settings

Name - AE Title:
IP Address:
Subnet Mask:
Default Gateway:

Remote Archive Setup
(Echo Server/GEMNet Server/EchoPac PC)

Name - AE Title:
IP Address:
Subnet Mask:
Default Gateway:
Server Name:
Remote DB User Name:

Services (Destination Devices)

	Device Type	Manufacturer	Name	IP Address	Port	AE Title
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Figure 2-2 Connectivity Installation Worksheet

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Table 2-6 Pre-Installation Check List

Action	Yes	No
Schedule at least 3 hours for installation of the system.		
Notify installation team of the existence of any variances from the basic installation.		
Make sure system and probes have been subject to acclimation period.		
Environmental cooling is sufficient.		
Lighting is adjustable to adapt to varying operational conditions of the scanner.		
Electrical facilities meet system requirements.		
EMI precautions have been taken and all possible sources of interference have been removed.		
Mandatory site requirements have been met.		
If a network is used, IP address has been set for the system and a dedicated network outlet is available.		

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Chapter 3 Installation

Section 3-1 Overview

3-1-1 Purpose of Chapter 3

This chapter provides instructions for installing the Vivid™ 3 ultrasound unit. Before beginning the installation process, an appropriate site must be prepared, as described in *Chapter 2 - Pre-Installation.* Once the site has been prepared, installation can proceed as described in this chapter.

Table 3-1 Contents in Chapter 3

Section	Description	Page Number
3-1	Overview	3-1
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Section 3-2
Installation Reminders

3-2-1 Average Installation Time

Once the site has been prepared, the average installation time required is shown in Table 3-2 below.

Table 3-2 Average Installation Time

Description	Average Installation Time	Comments
Unpacking the scanner	0.5 hour	
Installing the scanner	0.5 hour	Time may vary, according to the required configuration
DICOM Option (connectivity)	0.5 - 2.0 hours	Time may vary, according to the required configuration

3-2-2 Installation Warnings

1.) Since the Vivid™ 3 weighs 160 kg (353 lbs) or more, without options, two persons are always required to unpack it. This is also applicable when installing any additional items in excess of 16 kg (35 lbs).

2.) There are no operator-serviceable components. To prevent shock, do not remove any covers or panels. Should problems or malfunctions occur, unplug the power cord. Only qualified service personnel should carry out servicing and troubleshooting.

3-2-2-1 System Acclimation Time

Following transport, the Vivid™ 3 system may be very cold, or hot. Allow time for the system to acclimate before being switched ON. Acclimation requires 1 hour for each 2.5°C increment, when the temperature of the system is below 10°C or above 35°C.

CAUTION **Turning the system ON after arrival at the site - without allowing time for acclimation - may cause system damage!**

Table 3-3 Vivid™ 3 System Acclimation Time

°C	60	55	50	45	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
°F	140	131	122	113	104	96	86	77	68	59	50	41	32	23	14	5	-4	-13	-22	-31	-40
Hrs	8	6	4	2	0	0	0	0	0	0	0	2	4	6	8	10	12	14	16	18	20

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3-2-3 Safety Reminders

DANGER: WHEN USING ANY TEST INSTRUMENT THAT IS CAPABLE OF OPENING THE AC GROUND LINE (I.E., METER'S GROUND SWITCH IS OPEN), DO NOT TOUCH THE UNIT!

WARNING: Two people are required to unpack the unit, as it is heavy. Two people are also required whenever a part weighing 19kg (35 lb.) or more must be lifted.

CAUTION: If the unit is very cold or hot, do NOT turn ON power to the unit until it has had sufficient time to acclimate to its operating environment.

CAUTION: To prevent electrical shock, connect the unit to a properly grounded power outlet. Do NOT use a three-prong to two-prong adapter, as this defeats safety grounding.

CAUTION: Do NOT wear the ESD wrist strap when you work on live circuits where more than 30 V peak is present.

CAUTION: Do NOT operate the unit unless all board covers and frame panels are securely in place, to ensure optimal system performance and cooling.
When covers are removed, EMI may be present.

WARNING: ACOUSTIC OUTPUT HAZARD
Although the ultrasound energy transmitted from the Vivid™ 3 ultrasound unit is within AIUM/NEMA standards and FDA limitations, avoid unnecessary exposure. Ultrasound energy can produce heat and mechanical damage.

Note: The *Vivid™ 3 Pro/Vivid™ 3 Expert User Manual* should be fully read and understood before operating the unit. Keep the manual near the unit for reference.

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Section 3-3
Receiving and Unpacking the Equipment

CAUTION: Please read this section fully before unpacking the Vivid™ 3 ultrasound unit.

Note: The Vivid™ 3 ultrasound unit is shipped from the factory either in a wooden shipping crate, or in a cardboard shipping carton. Separate instructions are provided for opening and unpacking each type of container, as follows:

- Unpacking the Wooden Shipping Crate - see section 3-3-1 below.
- Unpacking the Cardboard Shipping Carton - see section 3-3-2 on page 3-9.

3-3-1 Unpacking the Wooden Shipping Crate

The Vivid™ 3 ultrasound unit is packed in a wooden crate that has four walls (*left*, *right*, *front* and *rear*), the crate base, and the top cover. Each section has rebated joints that are joined together with Clip-lok™ clips.

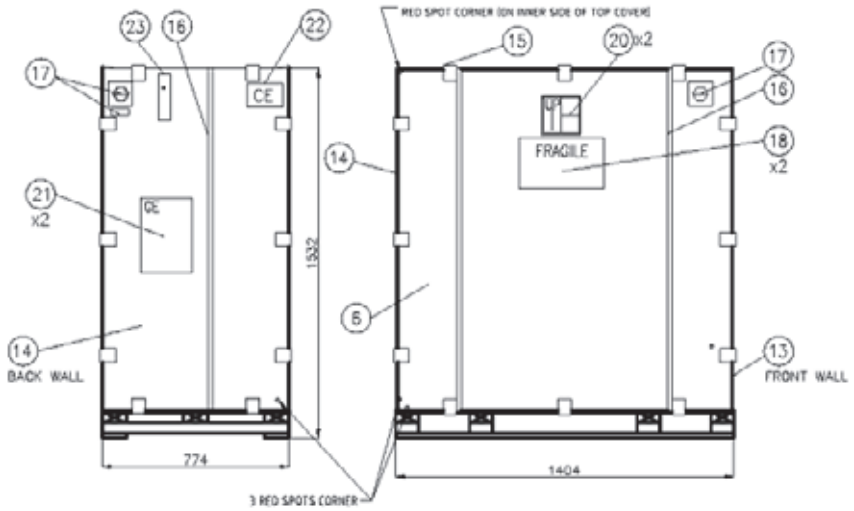

Figure 3-1 Vivid™ 3 - Wooden Shipping Crate

3-3-1-1 Removing the Clip-lok™ Clips

When unpacking the Vivid™ 3 ultrasound unit, always remove the Clip-lok™ clips as follows:

1) Locate and remove the clip remover tool (item 23) that is secured on the outside of the wooden crate, as shown in Figure 3-1, above.
2) Insert the hand level of the clip remover tool under the flange of the long leg of the clip.
3) Place your free hand over the clip to prevent injury when the clip is removed.
4) Rock the lever downwards towards the edge of the case, to remove the clip.

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3-3-1-2 Unpacking and Removing the Unit from the Wooden Crate

Before unpacking the unit, inspect the wooden crate for damage. Inspect the *Drop and Tilt* indicators (on the Shock-watch and Tilt-watch labels, respectively) for evidence of accidental shock or tilting of the crate during transit - see Figure 3-2 below).

NOTE: If the crate is damaged, or if either the Drop or Tilt indicators have turned red (showing failure), please inform the GE Medical Systems sales representative immediately. In addition, mark on the shipping consignment note or packing slip/post-delivery checklist (in the "Package" column) that the Tilt and/or Drop indicators show failure.

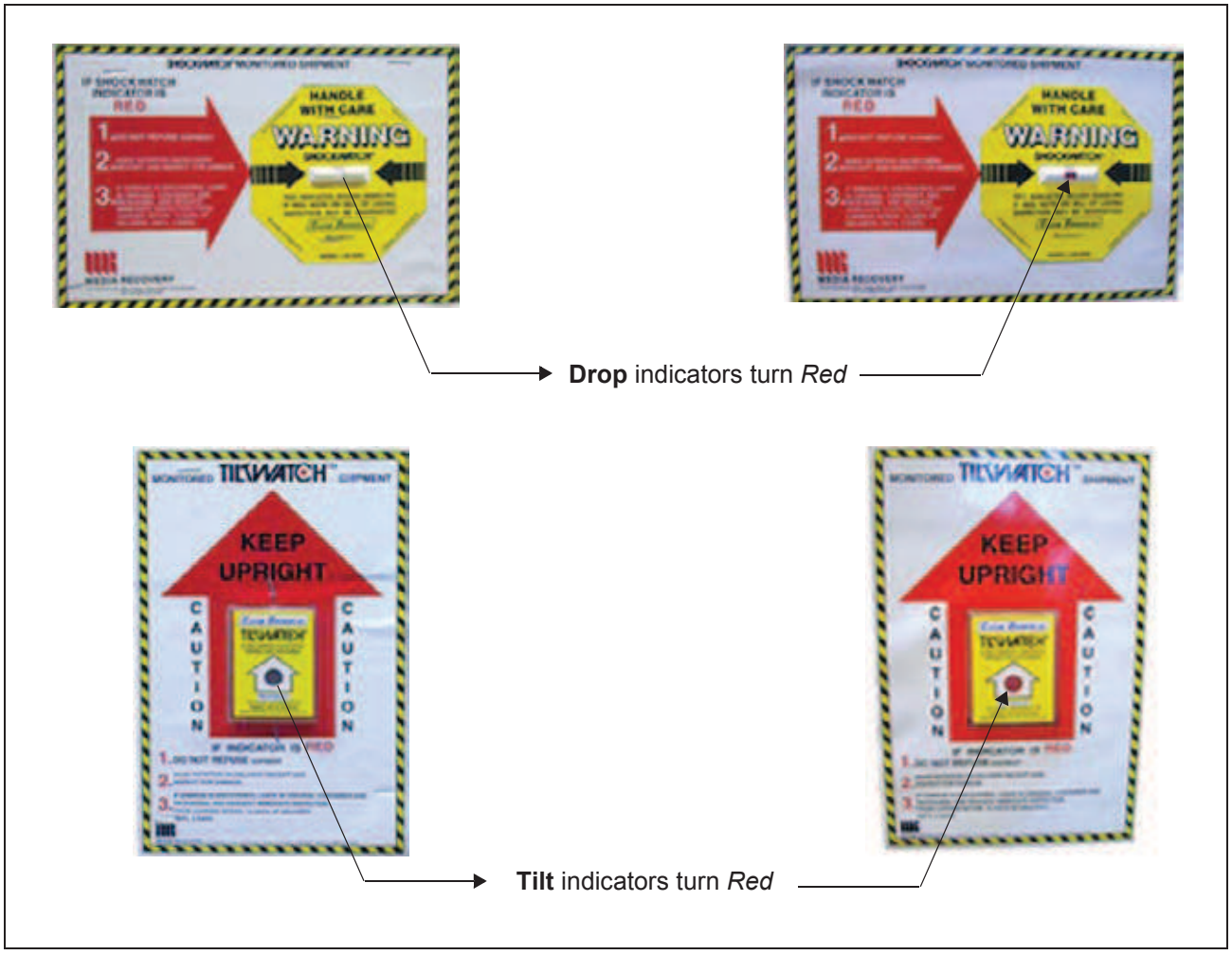

Figure 3-2 Drop and Tilt Indicators

It is recommended to keep and store the crate and all other packing materials (including the Clip-lok™ clips, support foams, anti-static plastic cover, etc.), in the event that transport or shipment of the unit to a different location will be required in the future.

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CAUTION: When using sharp tools to open packing materials, take care to avoid cutting or damaging the contents.

Note: Unless otherwise specified, referenced items are shown in Figure 3-1 on page 3-4.

1) Cut and remove the three securing steel strips (item 16).
2) Release the eight Clip-lok™clips (item 15) securing the front wall (item 13) and remove the front wall. (Refer to the procedure described in *Section 3-3-1-1* on page 3-4).
3) Release the eight Clip-lok™ clips securing the back wall (item 14) and remove the back wall.
4) Remove the small cartons containing the probes and peripheral options (items D and E in Figure 3-3 below) from the wooden crate.

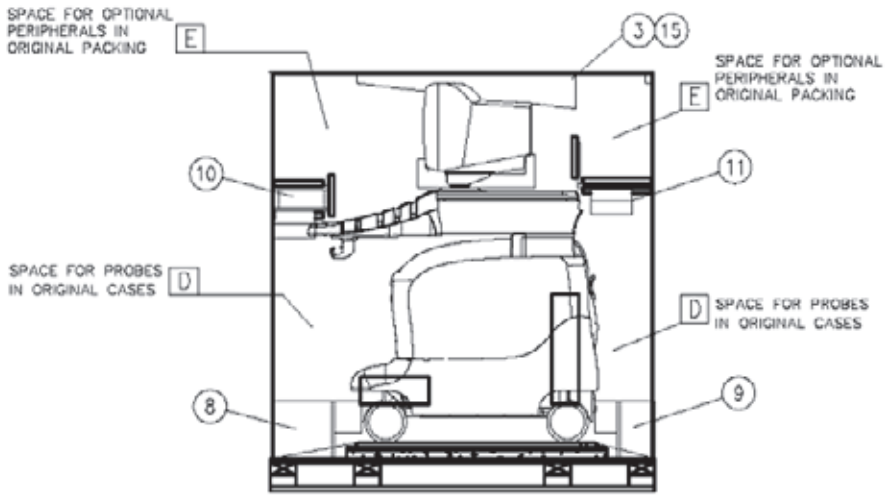

Figure 3-3 Probes and Peripherals in Original Packaging

5) Remove the console control support back foam (item 11 in Figure 3-3, above).
6) Remove the keyboard support foam located in front of the keyboard (item 10 in Figure 3-3, above).
7) Remove the back support foam located in front of the rear wheels (item 9 in Figure 3-3, above).
8) Remove the top cover by opening the six clips fastening it to the *right* and *left* walls. For details on opening the clips, refer to *Section 3-3-1-1* on page 3-4.
9) Remove the *right* wall (item 6) and the *left* wall (item 7) by opening the three clips fastening each to the base.
10) Cut and remove the antistatic sheet (item 2 in Figure 3-4 below) that is wrapped around the unit, taking care not to damage the antistatic cover.
11) Remove the antistatic cover (item 4 in Figure 3-4).

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12) Remove the two monitor foam supports (item 12 in Figure 3-4), located one on each side of the monitor.

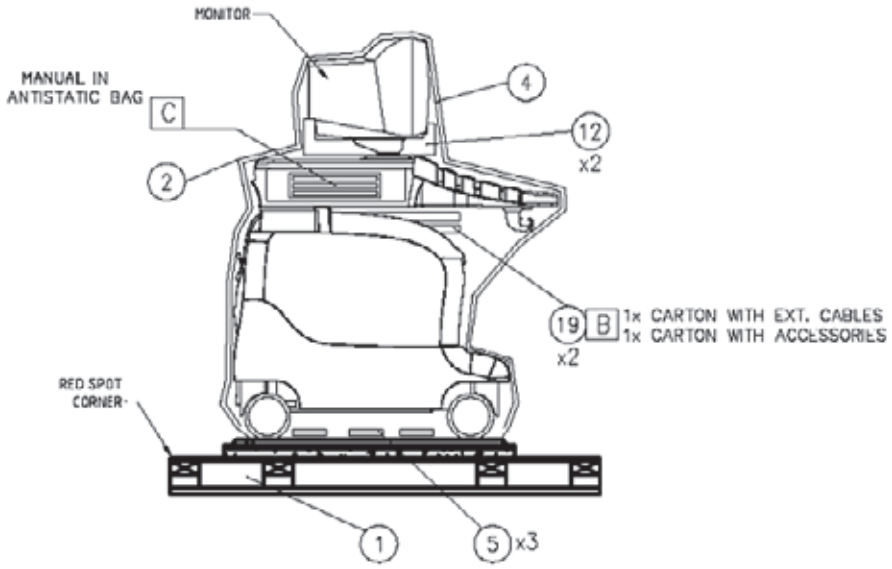

Figure 3-4 Antistatic Cover, Supports and Accessories

13) Remove the three silica gel (moisture absorbing) bags (item 5 in Figure 3-4, above) located under the unit.

14) Raise the control console (monitor) by pressing the release grip located under the unit's front handle.

15) Remove the two cartons containing the external cables and accessories located under the control console, and then lower the control console.

16) Lay the top cover (removed from the crate in step 8 on page 3-6) on the floor and push it over the narrow side of the base, in front of the unit, to act as a ramp (item 3 in Figure 3-5 below).

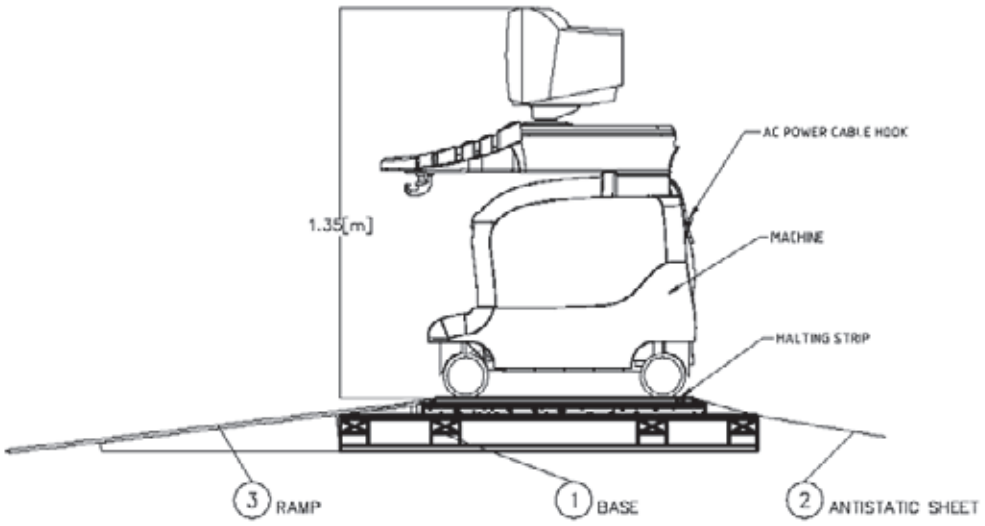

Figure 3-5 Removing the Unit from the Wooden Crate

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17) Press the brake pedal, located near the bottom of the front of the unit, to the right, to prevent the wheels from swiveling, as described in the *Swivel Brake Label* section, page 1-24.

18) Pull the unit backwards from the platform base onto the ramp and roll it down to the floor.

19) Press the brake pedal, located near the bottom of the front of the unit, to the left, to lock the wheels, as described in the *Parking Label* section, page 1-24.

20) Verify the contents of the case, as described in *Verifying the Shipping Crate Contents* on page 3-13.

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3-3-2 Unpacking the Cardboard Shipping Carton

The Vivid™ 3 ultrasound unit is packed in a cardboard shipping carton comprising a durable outer cardboard carton cover, and a wooden platform base; these are firmly joined together with clamps and screws. A ramp for rolling the Vivid™ 3 ultrasound unit off the platform, is also included.

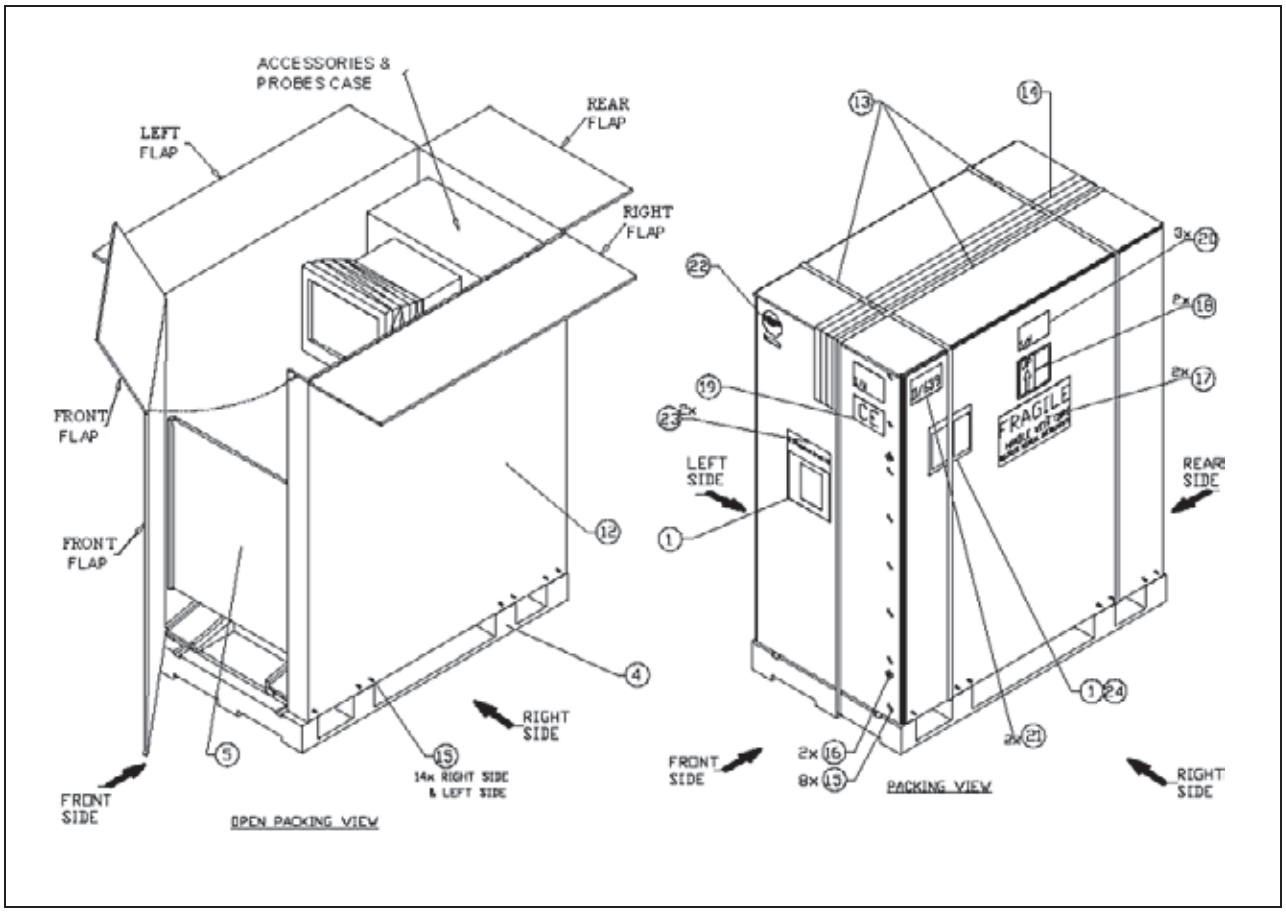

Figure 3-6 Vivid™ 3 - Cardboard Shipping Carton

3-3-3 Unpacking and Removing the Unit from the Cardboard Shipping Carton

Before unpacking the unit, inspect the carton case for damage. Inspect the *Drop and Tilt* indicators (on the Shock-watch and Tilt-watch labels, respectively) for evidence of accidental shock or tilting of the crate during transit - refer to Figure 3-2 on page 3-5.

NOTE: If the crate is damaged, or if either the Drop or Tilt indicators have turned red (showing failure), please inform the GE Medical Systems sales representative immediately. In addition, mark on the shipping consignment note or packing slip/post-delivery checklist (in the "Package" column) that the Tilt and/or Drop indicators show failure.

It is recommended to keep and store the cardboard shipping carton and all other packing materials (including the support foams, anti-static plastic cover, etc., in the event that transport or shipment of the unit to a different location will be required in the future.

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CAUTION: When using sharp tools to open packing materials, take care to avoid cutting or damaging the contents.

Note: Unless otherwise specified, referenced items are shown in Figure 3-6 on page 3-9.

1) Cut and remove the three securing steel strips (item 13).
2) Cut the adhesive tape along the center of the top of the cardboard shipping carton (item 14).
3) Remove all the fastening staples (item 15) and remove the two screws (item 16) so that the cardboard carton (item 12) is free of the wooden platform (item 4), and the narrow flap is free.
4) Open the narrow side flap of the carton, remove the ramp (item 5) and attach it to the narrow side of the wooden platform (item 4 in Figure 3-7 below).

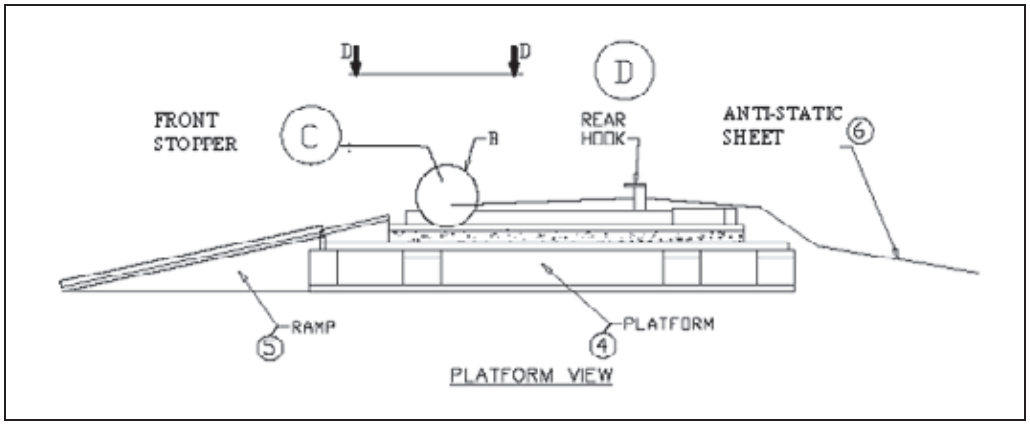

Figure 3-7 Platform View of Shipping Carton

5) Remove the small boxes containing the accessories, probes and peripherals from the shipping carton.
6) Clear away the carton cover (item 12) from the wooden platform on which the ultrasound unit is standing.
7) Cut and remove the antistatic sheet (item 6 in Figure 3-7, above) that is wrapped around the ultrasound unit, taking care not to damage the antistatic cover (item 11 in Figure 3-8 below) covering the unit. Remove the antistatic cover.

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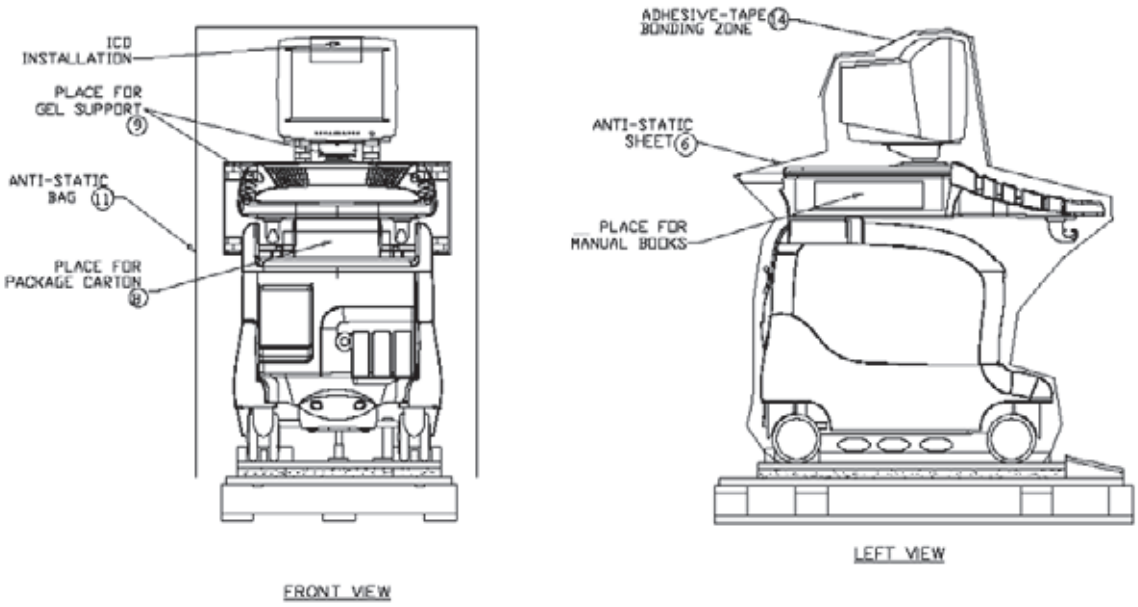

Figure 3-8 Front and Side View of the Unit in the Shipping Carton

8) Pull out and remove the monitor support (item 10 in Figure 3-9 below) from under the base of the monitor.

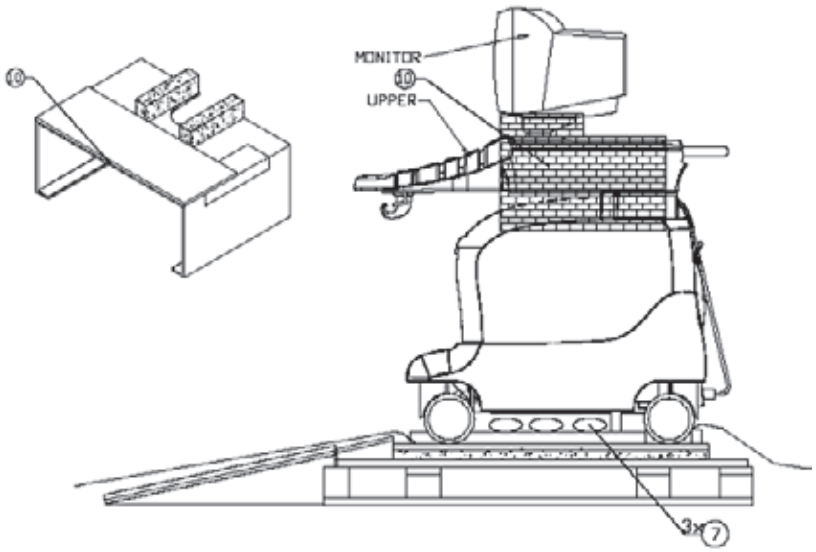

Figure 3-9 Unit in Shipping Carton - Right View

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9) Release the front stopper (item C in Figure 3-10 below) by sliding the metal sleeve located at the locking pin's base upwards, and then turning it towards you.

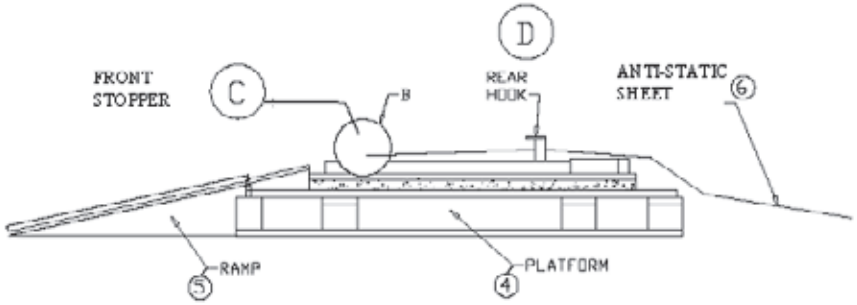

Figure 3-10 Front Stopper Location

10) Remove the three silica gel (moisture absorbing) bags (item 7 in Figure 3-10, above) located underneath the ultrasound unit.

11) Raise the control console (monitor) by pressing the release grip located under the unit's front handle and remove the two cartons (item 8 in Figure 3-8 on page 3-11) from underneath the control console. These cartons contain the external cables and accessories.

12) Lower the control console to its lowest position.

13) Remove the manuals (item 4 in Figure 3-8 on page 3-11) from the compartment on the left side of the ultrasound unit.

14) Press the brake pedal, located near the bottom of the front of the unit, to the right, to prevent the wheels from swiveling, as described in the *Swivel Brake Label* section, page 1-24.

15) Carefully pull the unit backwards from the platform base onto the ramp and roll it down to the floor.

16) Press the brake pedal, located near the bottom of the front of the unit, to the left, to lock the wheels, as described in the *Parking Label* section, page 1-24.

17) Verify the contents of the shipping carton, as described in Verifying the Shipping Crate Contents on page 3 - 13.

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Section 3-4
Preparing for Installation

3-4-1 Confirming Customer Order

When preparing for installation of a Vivid™ 3 system, it is important to verify that all items ordered by the customer have been received. Compare all items listed on the packing slip (shipping consignment note) with those received and report any items that are missing, back-ordered, or damaged, to your GE Medical Systems sales representative.

3-4-2 Verifying the Shipping Crate Contents

The following sections list the contents of the shipping crate (or shipping carton). Ensure that all components are present before completing the installation.

3-4-2-1 External Cables

The ECG cable (item number 10 or 11) is supplied according to installation location.

Table 3-4 Vivid™ 3 External Cables

Item Number	P/N	Description	Quantity
1	2269430	PWR. CORD, MALE/FEMALE, 10A/@%)V, 0.60M (PERIPHERALS)	1
2	2266746	AUDIO IN EXT. CABLE	1
3	2266745	AUDIO OUT EXT. CABLE	1
4	2266744	VIDEO OUT EXT. CABLE	1
5	2266743	VIDEO IN EXT. CBL.	1
6	2266742	RS232,D25 TO D9 CBL.	1
7	2253080	B/W PRINT TRIGGER CABLE	1
8	2253079	B/W VIDEO CABLE.	1
9	2300857	PRINTER POWER CABLE	1
10	2256477	ECG CABLES FOR AMERICAS & Japan	
	2269979	5 LEAD ECG CABLE L=3.6M	1
	2269982	LEAD WIRE, GRABBER, 1.3M, WHITE	1
	2269982-2	LEAD WIRE, GRABBER, 1.3M, GREEN	1
	2269982-3	LEAD WIRE, GRABBER, 1.3M, BLACK	1
11	2256478	ECG CABLES FOR EUROPE AND ALL OTHER COUNTRIES	
	2269980	5 LEAD ECG CBL.L=6.3M	1
	2269983	LEAD WIRE, GRABBER,1.3M, YELLOW	1
	2269983-2	LEAD WIRE, GRABBER,1.3M, BLACK	1
	2269983-3	LEAD WIRE, GRABBER,1.3M, RED	1

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3-4-2-2 Accessories

Table 3-5 Vivid™ 3 Accessories

Item Number	P/N	Description	Quantity
1	2378183	CD WITH SW V3.2 VIVID3 SYSTEM	1
2	2277423	DISKETTE 3.5” 1.44MB	1
3	066E0007	FOOTSWITCH	1
4	E11821AE	ULTRASOUND GEL BOTTLE	1
5	2277190	MO DISKETTE 2.3GB (OPTIONAL)	1

3-4-3 Component Inspection

After verifying that all the required parts are included in the shipping crate, inspect the system components using the checklist supplied below. In addition, ensure that all the labels described in *Chapter 1 - Introduction* are present, accurate and in good condition, and enter the serial number printed on the main label into the system installation details card, as described in *System Installation Details* on page 3-76.

3-4-3-1 Damage Inspection Checklist

Visually inspect the contents of the shipping crate/shipping carton for damage. If any parts are damaged or missing, contact an authorized GE Service Representative.

A *Damage Inspection Checklist* is provided in Table 3-6 on page 3-15.

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Table 3-6 Damage Inspection Checklist

✔	Step	Item	Recommended Procedure
	1	Console	Verify that the system is switched OFF and unplugged. Clean the console and control panel.
	2	Probe Holders	Clean the gel wells with warm water and a damp cloth to remove all traces of gel.
	3	Control Panel	Physically inspect the control panel for missing or damaged items. Verify the proper illumination of all the control panel buttons.
	4	Probes	Check all probes for wear and tear on the lens, cable, and connector. Look for bent or damaged pins on the connector and in the connector socket on the unit. Verify that the EMI fingers around the probe connector socket housing are intact. Check the probe locking mechanism and probe switch.
	5	Monitor	Clean the CRT with a soft cloth dampened with water. Repeat using only water, and wipe with a dry cloth. Inspect the monitor for scratches and raster burn.
	6	Fans	Verify that the FE crate cooling fans, BE fan and peripheral fans are operating and clean.
	7	BE Rear Panel	Check the BE rear panel connectors for bent pins, loose connections and loose or missing hardware. Screw all the cable connectors tightly to the connector sockets on the panel. Verify that the labeling is in good condition.
	8	Covers	Check that all screws are in place, all chassis and internal covers are installed and that the air filters are in place.
	9	Peripherals	Check and clean the peripherals in accordance with the manufacturer's directions. To prevent EMI or system overheating, dress the peripheral cables inside the peripheral cover.
	10	AC System	Check the AC board connectors and the associated cabling for good connection and proper insulation. Verify that the connections are secured.
	11	Power Cord	Check the power cord for cuts, loose hardware, tire marks, exposed insulation, or any deterioration. Verify continuity. Tighten the clamps that secure the power cord to the unit and the outlet plug to the cord. Replace the power cord and/or clamp, as required.
	12	Front Castors	Check that the front castors can swivel, and can be placed in swivel lock and full lock by the foot brake pedal.
	13	Rear Castors	Check that the rear castors can roll and swivel but cannot lock.

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3-4-3-2 Front and Side View of the Vivid™ 3 Ultrasound Unit

Figure 3-11 below shows the Vivid™ 3 ultrasound unit components that are visible from the *front* and *side* of the ultrasound unit.

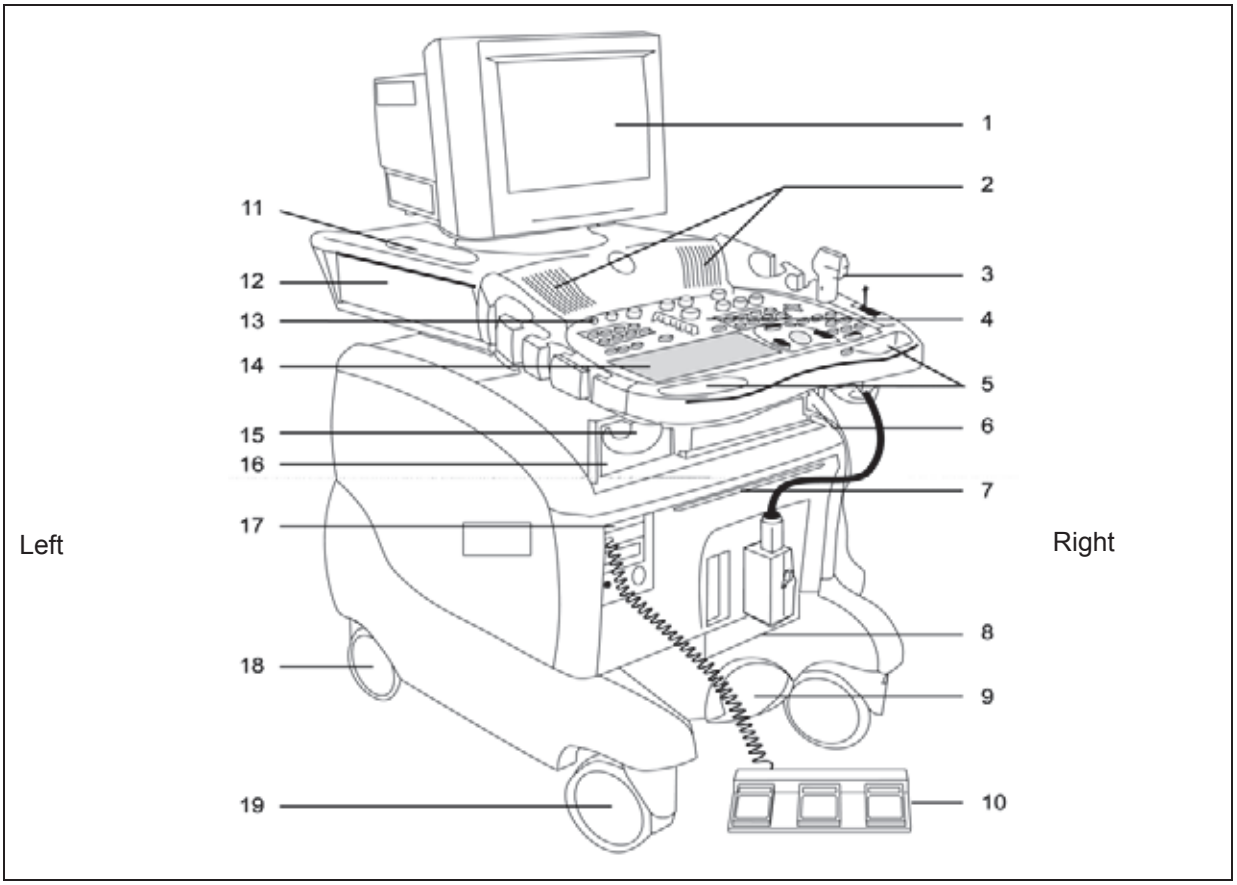

Figure 3-11 Front and Side View of the Vivid™ 3

1 Display Monitor: Swivels to the left and right, and tilts up and down.

2 Speakers: Two loudspeakers for Doppler sound.

3 Probe Holders and Probes: Situated on either side of the front panel.

4 Control Panel: Contains the alphanumeric keyboard and the buttons used to operate the ultrasound unit.

5 Front Handle.

6 Raise/Lower the Control Console Up/Down Handle: Located midway underneath the front handle. Used to raise or lower the control console (control panel and monitor).

7 Air Filter: Located above the crate.

8 Probe Ports:

- Three active probe connectors (one for a pencil probe), and a fourth, inactive port on the right side of the unit, which is used for parking.
- Four active probe connectors (one for a pencil probe).

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9 Foot Brake: Three-position brake, as follows:

- LEFT (P) locks the wheels.
- MIDDLE unlocks the wheels.
- RIGHT (double arrows) locks the swivel action.

10 Footswitch: Configurable footswitch connected to the patient I/O module that enables keyboard commands to be operated by foot.

11 Gel Holders: Situated on either side of the control console, and on the top surface on either side of the monitor.

12 Optional storage compartment.

13 On/Off Switch.

14 Alphanumeric Keyboard and Operation Buttons.

15 Cable Hook.

16 Peripherals: The VCR recorder and/or black-and-white printer and/or color printer are positioned on the peripheral storage area of the control console.

17 CD Read/Write (CDRW) and MO Disk (optional).

18 Rear Castors.

19 Front Castors.

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3-4-3-3 Rear View of the Vivid™ 3 Ultrasound Unit

The following figure shows the Vivid™ 3 ultrasound unit components that are visible from the *rear* of the ultrasound unit:

Figure 3-12 Rear View of the Vivid™ 3

1 Monitor

2 Gel Wells

3 Monitor Connection Panel

4 Left Rear Panel

5 Right Rear Panel

6 Power Cable Storage Hook

7 Circuit Breaker On/Off Switch

8 Ground Screw

9 Power Cable Socket

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3-4-4 System Voltage Confirmation

3-4-4-1 System Voltage Settings

Verify that the scanner is set to the correct voltage.
The Voltage settings for the Vivid™ 3 Scanner are found on a label to the right of the Power switch and External I/O, on the rear of the system.

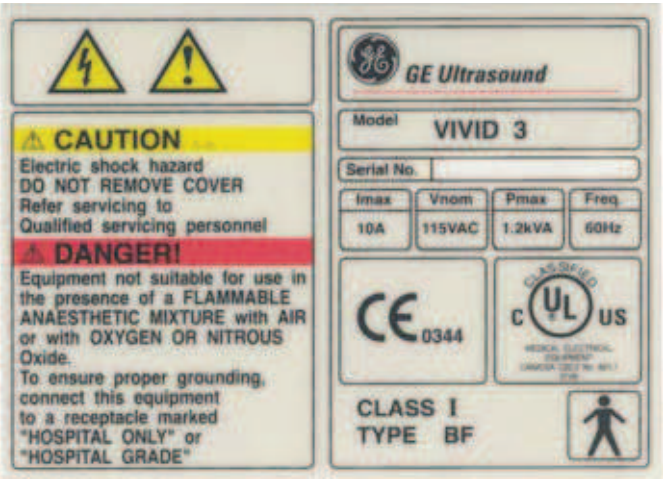
CAUTION
Electric shock hazard
DO NOT REMOVE COVER
Refer servicing to
Qualified servicing personnel
DANGER!
Equipment not suitable for use in the presence of a FLAMMABLE ANAESTHETIC MIXTURE with AIR or with OXYGEN OR NITROUS Oxide.
To ensure proper grounding, connect this equipment to a receptacle marked "HOSPITAL ONLY" or "HOSPITAL GRADE"
GE Ultrasound
Model VIVID 3
Serial No.
Imax 10A
Vnom 115VAC
Pmax 1.2kVA
Freq. 60Hz
CE 0344
c UL us
CLASS I
TYPE BF

Figure 3-13 Rating Plate Example

WARNING: CONNECTING A VIVID™ 3 SCANNER TO THE WRONG VOLTAGE LEVEL WILL MOST LIKELY DESTROY THE SCANNER.

3-4-4-2 Confirming System Voltage Configuration

1) Turn ON the system.
2) In regular 2D Scanning Mode, press **Config**.
3) From the System Configuration dialog box, click the **Technical Support** tab.
4.) Make sure the frequency and voltage ranges are set up correctly and that the appropriate settings are displayed in the *Power* Supply *Frequency* and *Nominal Voltage* fields (lower right side of the dialog box - see Figure 3-28 on page 3-47).
5) Click **OK**.

Note: If the voltage is not set correctly, contact an authorized GE Service Representative.

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3-4-5 Video Formats Confirmation

The Vivid™ 3 ultrasound scanner and VIC may be configured to operate with either PAL or NTSC video systems, as required.

3-4-5-1 Video Format Confirmation

1) Turn ON the system and the check video transmission signal is set correctly.
2) Press **Config**.
3) From the System Configuration dialog box, select the **VCR/ECG** tab and make sure Either **PAL** or **NTSC** is selected.
4) Click the **Technical Support** tab and make sure Frequency is set to either **60Hz** for NTSC, or **50Hz** for PAL.
5) Click **OK**.

Note: If the video format is not set correctly, contact an authorized GE Service Representative.

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3-4-6 Ensuring Protection from EMI

The Vivid™ 3 unit has been designed to minimize the effects of Electo-Magnetic Interference (EMI). Many of the covers, shields, and screws are provided primarily to protect the system from image artifacts caused by this interference. For this reason, it is imperative that all covers and hardware are installed and secured before the unit is put into operation.

Ensure that the system is protected from electromagnetic interference (EMI), as follows:

- Operate the system at least 15 feet away from equipment that emits strong electromagnetic radiation.
- Operate the system in an area enclosed by walls, floors and ceilings comprised of wood, plaster or concrete, which help prevent EMI.
- Shield the system when operating it in the vicinity of radio broadcast equipment, if necessary.
- Do not operate mobile phones or other EMI emitting devices in the ultrasound room.
- Verify that all EMI rules listed in the following table are followed:

Note: The Vivid™ 3 ultrasound unit is approved for use in hospitals, clinics and other environmentally qualified facilities, in terms of the prevention of radio wave interference. Operation of the ultrasound unit in an inappropriate environment can cause electronic interference to radios and television sets situated near the medical equipment.

Table 3-7 EMI Prevention/ Abatement

EMI Rule	Details
Ground the unit.	Poor grounding is the most likely reason an ultrasound unit will have noisy images. Check the grounding of the power cord and power outlet.
Be aware of RF sources.	Keep the unit at least 5m (16.4 ft) away from other EMI sources. Special shielding may be required to eliminate interference problems caused by high frequency, high powered radio or video broadcast signals.
Replace and/or reassemble all screws, RF gaskets, covers and cores.	After you finish repairing or updating the system, replace all covers and tighten all screws. Any cable with an external connection requires a magnet wrap at each end. Install the shield over the front of the card cage. Loose or missing covers or RF gaskets allow radio frequencies to interfere with the ultrasound signals.
Replace broken RF gaskets.	If more than 20% or a pair of the fingers on an RF gasket are broken, replace the gasket. Do not turn on the unit until any loose metallic part is removed and replaced if needed.
Do not place labels where RF gaskets touch metal.	Never place a label where RF gaskets meet the unit. Otherwise, the gap created will permit RF leakage. In case a label has been found in such a location, move the label to a different appropriate location.
Use GE specified harnesses and peripherals.	The interconnect cables are grounded and require ferrite beads and other shielding. Cable length, material, and routing are all important; do not make any changes that do not meet all specifications.
Take care with cellular phones.	Cellular phones may transmit a 5 V/m signal that causes image artifacts.
Properly address peripheral cables.	Do not allow cables to lie across the top of the card cage or hang out of the peripheral bays. Loop any peripheral cable excess length inside the peripheral bays or hang on the hooks provided below the console. Attach the monitor cables to the frame.

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Section 3-5
Completing the Hardware Installation

It is recommended to pay attention to the system specifications and make sure the facility has been prepared in accordance with the information provided in *Chapter 2 - Pre-Installation*.

For easy reference, the physical specifications of the Vivid™ 3 ultrasound unit are shown in Table 3-8 below.

Table 3-8 Vivid™ 3 - Physical Specifications

Measurement	Metric Specifications	Imperial Specifications
Height (with monitor)	131 — 145 cm	51.6 — 57.1 in
Width	62.5 cm	25 in
Depth	112 cm (100 cm without rear handle)	44 in (40 in without rear handle)
Weight	160 kg	353lbs

When moving the system, always adhere to the following the precautions:

CAUTION: At least two people must be available to deliver and unpack the Vivid™ 3 ultrasound unit. Attempts to move the unit considerable distances (or on an incline) by one person alone, could result in personal injury, and/or damage to the system.

CAUTION: The Vivid™ 3 weighs 160 kg (353 lbs) or more - depending on installed peripherals - when ready for use. Care must be used when moving it or replacing its parts. Failure to follow the precautions listed could result in injury, uncontrolled motion and costly damage.

ALWAYS:

Be sure the pathway is clear.

Use slow, careful motions.

Use two people when moving the system on inclines or lifting more than 16 kg (35 lbs).

3-5-1 Connecting the Footswitch

1) Connect the triple footswitch to the **Footswitch** input on the left side of the front panel, as shown in Figure 3-8 on page 3-11.
2) After connecting the peripherals and switching the system on, configure the footswitch, as described in *System Tab* on page 3-36.

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3-5-2 Connecting Peripherals

Peripheral devices, such as a VCR or printer, are connected to the Vivid™ 3 ultrasound unit using the rear panel connectors. Ensure that all peripheral devices connected to the ultrasound unit comply with national safety requirements for medical equipment, including IEC601, CSA22.2, AS3200.1 and UL544.

The Vivid™ 3 ultrasound unit can operate with one or more of the following types of on-board peripherals:

- VCR
- Black & White (B/W) Printer
- Color Printer
- Deskjet Color Printer HP6122

Note: Each of the peripherals have European and US versions. For a complete list of recommended peripherals, refer to the *Vivid™ 3 Pro/Vivid™ 3 Expert User Manual*. For information for each peripheral device, refer to the manufacturer's manual.

On-board peripherals must be connected to one of the two available auxiliary power supplies on the right rear panel. The total load on both auxiliary AC outlets should not exceed 500 VA. This means 8 Amp @ 100-120V AC or 4 Amp @ 220-240V AC.

Voltages are set according to local country voltage, as described in the *Voltage Level Checks* section, on page 3-31.

For more details about peripherals installation refer to *Vivid™ 3 Peripherals Installation Manual.*

3-5-2-1 Rear Panel Connectors

The Vivid™ 3 ultrasound unit is equipped with two rear panels that provide the connections for peripheral devices, as shown in Figure 3-14 below.

Note: Right and left are determined from the front of the unit. Refer to the *Right Rear Panel Connectors* section, on page 3-24, and to the *Left Rear Panel Connectors* section, on page 3-25, for details about each panel.

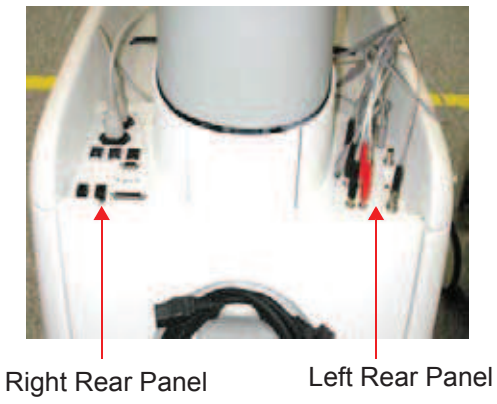

Figure 3-14 Rear Panel Connectors Rear View

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3-5-2-1-1 Right Rear Panel Connectors

Table 3-9 describes the connectors included in the right rear panel (shown in Figure 3-15):

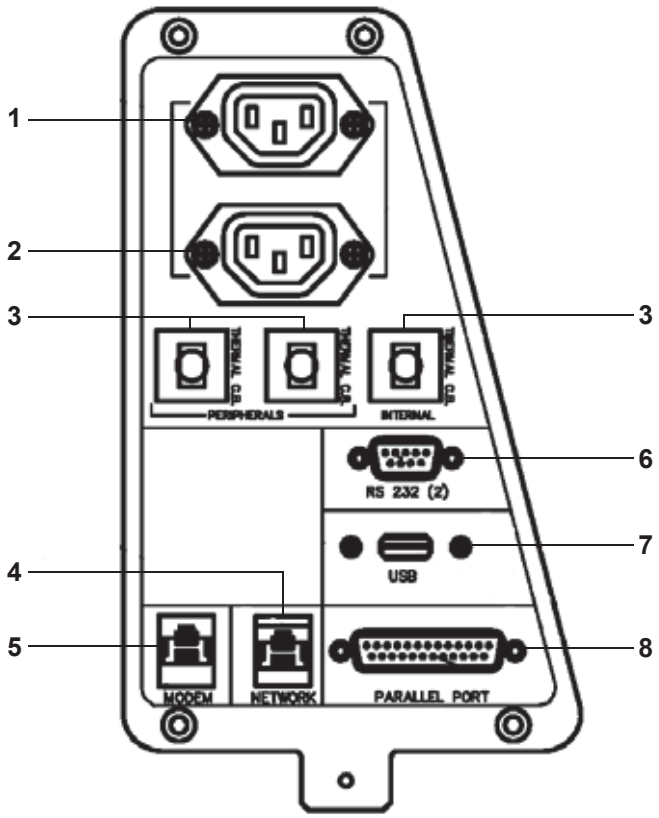

Figure 3-15 Right Rear Panel Connectors

Table 3-9 Right Rear Panel Connectors

Name	Description
1. AUXILIARY AC OUTLET	For use with external peripherals. Voltages are set according to local country voltage.
2. AUXILIARY AC OUTLET	For use with external peripherals. Voltages are set according to local country voltage. If additional auxiliary outlets are required, use the special cable provided by GE. **DO NOT** attempt to connect additional peripherals using an external wall outlet.
3. THERMAL CIRCUIT BREAKERS	Three 4A thermal circuit breakers for fuse protection.
4. NETWORK	For the network connection.
5. MODEM	For use with the service platform (iLinq).
6. RS 232 (2)	Not in use.
7. USB	For GE Service usage only (not for external USB devices).
8. PARALLEL PORT	25 pin connector for use with the external peripherals.

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3-5-2-1-2 Left Rear Panel Connectors

Table 3-10 describes the connectors included in the left rear panel (shown in Figure 3-16):

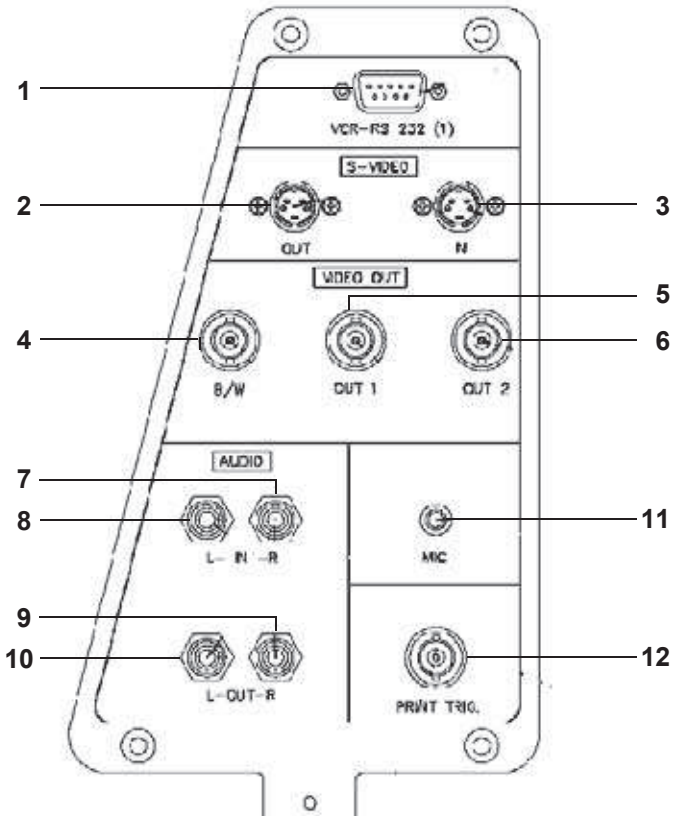

Figure 3-16 Left Rear Panel Connectors

Table 3-10 Left Rear Panel Connectors

Name	Description
1. VCR-RS 232 (1)	One standard 9-pin RS232 (1) connector for VCR control (COM 1).
2. S-VIDEO OUT	Y/C Video Out: 4 pin connector for output to an S-VHS VCR.
3. S-VIDEO IN	Y/C Video In: 4 pin connector for input from an S-VHS VCR.
4. VIDEO OUT B/W	BNC connector for composite B/W video output to a hard copy printer.
5. VIDEO OUT 1	BNC connector for composite color video output (PAL or NTSC).
6. VIDEO OUT 2	BNC connector for composite color video output (PAL or NTSC).
7. AUDIO IN (RIGHT)	RCA jack.
8. AUDIO IN (LEFT)	RCA jack.
9. AUDIO OUT (RIGHT)	RCA jack.
10. AUDIO OUT (LEFT)	RCA jack.
11. MIC	Microphone input.
12. PRINT TRIG.	BNC connector for the exposure control of a multi-imager or another peripheral activated by pressing **Print B.**

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3-5-2-2 Connecting the VCR

1) Place the VCR on the peripheral tray and connect the following:

Table 3-11 VCR Cables

From the VCR	To the Left Panel	DIP on VCR Right Panel
S-Video IN	S-Video OUT (Y/C OUT)	1-4 OFF (down)
S-Video OUT	S-Video IN (Y/C OUT)	5-6 ON (up)
Audio IN	Audio OUT	
Audio OUT	Audio IN	
BE Control (RS-232)	VCR RS 232 (1)	

2) Install the VCR according to the VCR installation schematics, see Figure 8-159 on page 8-161.

3) After connecting the remaining peripherals and switching the system on, configure the VCR settings, as described in the *VCR/ECG Tab* section, on page 3-45.

For more details about peripherals installation refer to the *Vivid™ 3 Peripherals Installation Manual.*

3-5-2-3 Connecting the Black & White Printer

1) Place the printer on the peripheral tray and connect the following cables as shown in Table 3-12.

Table 3-12 Black & White Printer Cables

From the Printer	To the Left Panel
Video IN	Composite Video OUT B/W
External Trigger	Print Trigger
Power Cable	Right Connectors Panel AC outlet

2) Install the printer according to the printer's installation schematics, see Figure 8-110 on page -126.

3) After connecting the remaining peripherals and switching the system on, configure the printer settings, as described in the *Printers Tab* section, on page 3-43.

For more details about peripherals installation refer to the *Vivid™ 3 Peripherals Installation Manual.*

3-5-2-4 Connecting the Color Printer

1) Place the color printer in the printer compartment above the B/W printer and VCR on the peripheral tray, using an additional shelf.

2) Connect the following cables as shown in Table 3-13:

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Table 3-13 Color Printer Cables

From the Color Printer	To the Cables underneath the Control Console
Video IN	Composite/Video OUT 1
External Trigger	Print Trigger
AC IN	AC Power Cable

Note: All the color printer cables are located in the left storage compartment under the metal cover.

3) After connecting the remaining peripherals and switching the system ON, configure the printer settings, as described in the *Printers Tab* section, on page 3-43.

For more details about peripherals installation, refer to the *Vivid™ 3 Peripherals Installation Manual.*

3-5-2-5 Connecting the DeskJet Color Printer HP6122

Note: If there is sufficient space, the DeskJet Color Printer may be installed under the control console. Alternatively, it will require a suitable stand or table to be positioned in close proximity to the Vivid™ 3 scanner - at a distance of *not more than* 1m (3.3 ft) from the power connection to the Vivid™ 3 unit.

WARNING: Whenever moving the Vivid™ 3 scanner, the DeskJet Color Printer must be disconnected from the scanner. DO NOT attempt to move the two units simultaneously without first disconnecting them. After relocation, re-connect the printer to the scanner.

1) Place the DeskJet color printer on the shelf below the control console (or alternatively on the designated stand or table, adjacent to the unit).
2) Connect the following cables as shown in Table 3-14:

Table 3-14 DeskJet Color Printer Cables

From the Color Printer	To the Right Panel
Parallel Port Connector	Parallel Port
AC IN (AC Dual Power cable)	Panel AC outlet

3) After connecting the remaining peripherals and switching the system ON, configure the printer settings, as described in the *Printers Tab* section, on page 3-43.

For more details about peripherals installation refer to the *Vivid™ 3 Peripherals Installation Manual.*

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3-5-3 Connecting Probes

The Vivid™ 3 ultrasound unit operates with various types of probes that are used for scanning patients, including flat phased, convex and linear electronic array probes. Once connected, the probes can be selected for different applications.

Probe connectors on the unit's control panel are as follows:

- Three active probe connectors (one for a pencil probe), and a fourth, inactive port on the right side of the unit, which is used for parking.

  OR

- Four active probe connectors (one for a pencil probe).

Probes can be connected or changed any time, as described below:

1) Inspect the probe socket to verify that it is free of debris.
2) Hold the rectangular probe connector vertically so that the probe's cable points upwards.
3) Rotate the probe locking latch *counterclockwise* to the unlock (horizontal) position.
4) Gently insert the connector into one of the matching sockets on the front of the unit. Gently push the connector in as far as possible.
5) Rotate the locking latch 90 degrees *clockwise* to lock the connector into place (vertical).

NOTE: It is not necessary to turn OFF power to connect or disconnect a probe.

3-5-3-1 Available Probes

The following probes are available for use with the Vivid™ 3 ultrasound unit:

Table 3-15 Available Probes

P/N	Description
2232337	3S SECTOR (new design)
2259135	7L (546L)
2259145	10L (739L) LINEAR
2259153	C358 PROBE (OUTSIDE JAPAN)
2259206	I739L LINEAR
2295377	12L
2263669	7S SECTOR
2266328	10S
2169773	P509 (Japan)
2259246	T739L LINEAR
KN100011	5T TEE MULTIPLANE
KN100022	6T (Super TEE)
KN100023	8T (Ped TEE)
KN100072	9T(PED TEE) (for RFI systems only)
KZ200476	5S SECTOR
TE100024	Pencil P2D
TQ100002	Pencil P6D
KZ200476	Adaptor PAMPTE/6Tv
2301954	E721
KQ100006	i8L
KW100011	i13L

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3-5-4 Connecting the ECG

The internal ECG is connected into a rectangular-shaped socket on the patient trace (I/O) panel. The patient trace (I/O) panel is located on the front of the ultrasound unit, as shown in Figure 3-11 on page 3-16. Each socket is clearly labelled and color coded, as shown in Figure 3-17 below.

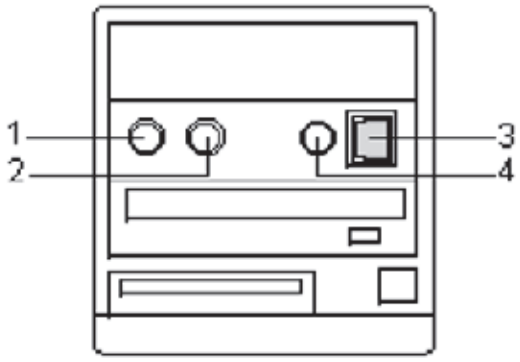

Figure 3-17 Connection Sockets for ECG Cables

1 Footswitch (black)

2 Phono (blue)

3 ECG (green)

4 External ECG (yellow)

The ECG cable is a modular cable consisting of four different cable parts. The main part (trunk) is a single cable connecting to the unit at one end, and providing a cable splitter device at the other end. The splitter contains five receptacles, only three of which are used with the Vivid™ 3 Pro/Vivid™ 3 Expert ultrasound unit.

Three color coded electrode cables are inserted into the splitter in the appropriate color-coded receptacles. Each electrode cable hooks up to the appropriate stick-on electrode by a clip-type connector. The color coding of the electrodes follows one of two standards that are common in different parts of the world. The cable splitter has a drawing defining the color codes, names and electrode placements for each of the three cables, as shown in Figure 3-18 on page 3-30.

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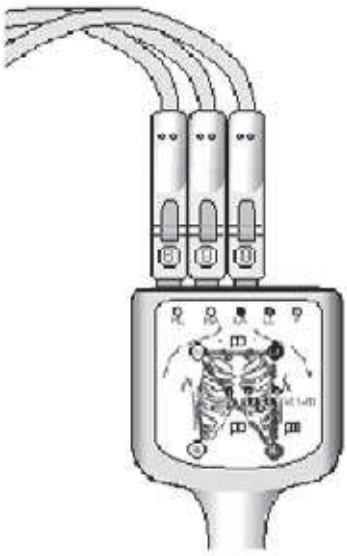
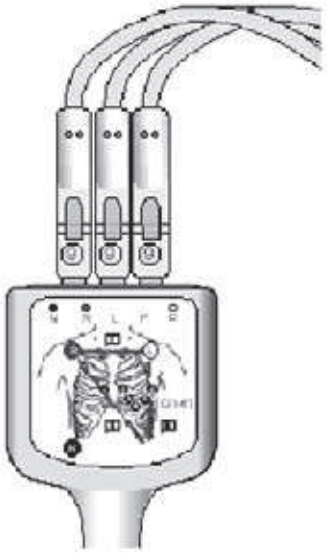


AHA (Americas, Japan)



IEC (Europe, Asia, ROW)

Figure 3-18 ECG Cable and Electrode Placement

Note: For optimal ECG operation, use only electrodes that meet universal standards - see Table 3-16.

Table 3-16 ECG Cable Types

Description		Part No.
Full ECG Cable Kit - AHA (Americas, Japan)		**2256477**
	Black wire (LA)	2269982-3
	White wire (RA)	2269982
	Green wire (RL)	2269982-2
Full ECG Cable Kit - IEC (Europe, Asia, ROW)		**2256478**
	Yellow wire (L)	2269983
	Red wire (R)	2269983-3
	Black wire (N)	2269983-2

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3-5-5 Connecting the Unit to a Power Source

The initial connection of the Vivid™ 3 ultrasound unit to a power source should be performed by a qualified person, authorized by GE Medical Systems. Use only the power cords, cables and plugs provided by or designated by GE Medical Systems to connect the unit to the power source.

CAUTION: Verify compliance with all electrical and safety requirements and check the power cord to verify that it is intact and of hospital-grade before connecting the unit to the power source. Products equipped with a power source (wall outlet) plug should be connected to the fixed power socket that has a protective grounding conductor. Never use an adapter or converter to connect with a power source plug (for example, a three-prong to two-prong converter).

3-5-5-1 Voltage Level Checks

The following voltage level checks are required:

1) Check the rating label at the rear of the ultrasound unit, as described in *Chapter 1 - Introduction*, and verify that your local AC Voltage corresponds to the voltage setting as indicated on the rating label. The rating label indicates that the factory preset input AC voltage is one of the following:
   - 100 V
   - 120 V
   - 220 - 240 V
2) Verify the maximum power requirement as follows:
   - Maximum power = 1.2 KVa (the system might need)
   - 100 V 60-50 Hz 8A
   - 120 V 60-50 Hz 8A
   - 220 - 240 V 60-50 Hz 4A

DANGER: Failure to provide an adequate earth circuit (Ground) may cause electrical shock and serious injury.

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3-5-5-2 Connecting the Ultrasound Unit to the Electrical Outlet

Note: To help assure grounding reliability, connect to a hospital-grade or “hospital only” grounded power outlet. If using the ultrasound unit with an external UPS system, follow all the grounding and applicable safety standards as documented both in this manual and the external UPS manufacturer’s manual. The external UPS system is to be considered the AC outlet.

1) Verify that the AC wall outlet is of the appropriate type.
2) Turn off the AC circuit breaker at the rear of the unit.
3) Plug the power cord connector into the AC input socket, and secure it in place using the attached clip - see Figure 3-19

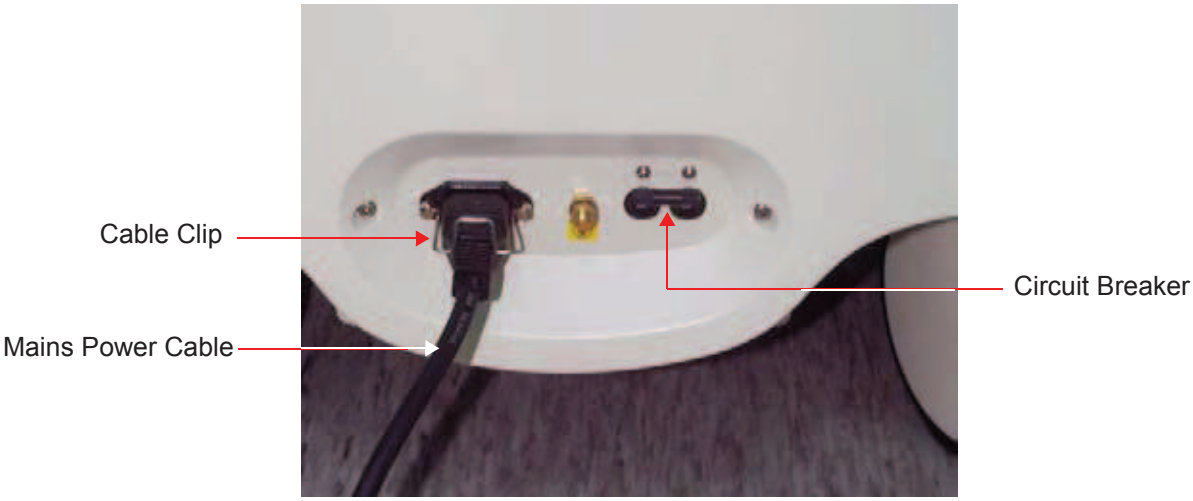

Figure 3-19 Circuit Breaker and Power Cable on Back of Scanner

4) Plug the other end of the power cord to the AC wall outlet. Allow sufficient slack so that the plug will not be pulled out if the unit is slightly moved. The remaining length of the cord should be looped and hung on the hook provided.

DANGER: To avoid the risk of fire, power to the system must be supplied from a separate, properly rated outlet. It is recommended to use a dedicated power outlet. The power plug should not, under any circumstances, be altered to a configuration rated less than that specified for the current. DO NOT use an extension cord or adaptor plug. Refer to the *Electrical Requirements* section, on page 2-3 for more details.

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3-5-5-3 Disconnecting the Ultrasound Unit from the Electrical Outlet

CAUTION: Whenever disconnecting the Vivid™ 3 unit from the electrical outlet, always observe the safety precautions. First unplug the mains power cable from the wall outlet socket, then from the unit itself. Remove by pulling on the cable connector - DO NOT pull on the cable.

1) Turn OFF the AC circuit breaker on the rear of the unit.
2) Unplug the mains power cable from the AC wall outlet socket.
3) Unplug the mains power cable connector from the AC input socket (refer to Figure 3-19 on page 3-32).

NOTICE Disconnecting the Mains Power Cable *before* switching OFF the Circuit Breaker will activate the uninterruptible power system (UPS) in the back-end processor, forcing an ordered shutdown of the system.

3-5-6 Switching the System ON/OFF

3-5-6-1 Switching the System ON

1) Verify that the ultrasound unit has been connected to the power supply and that the circuit breaker is ON, as described in the *Connecting the Ultrasound Unit to the Electrical Outlet* section, on page 3-32.

NOTICE When AC power is applied to the scanner, the **On/Off** button on the control console illuminates amber, indicating the Back-end Processor is in *Standby* mode.

2) Hold down the **On/Off** button on the control panel for 3 seconds. The system automatically performs an initialization sequence which includes the following:
   - Loading the operating system.
   - Running a quick diagnostic check of the system.
   - Detecting connected probes.

The system first enters 2D-Mode with the probe and application that were last used before the system was shut down. If the probe has been removed since the system was last used, the currently connected probes and their available applications are displayed and selected by default.

3-5-6-2 Switching the System OFF

NOTE: After turning OFF the system, wait at least 10 seconds before turning it on again. The system may not be able to boot-up if power is recycled too quickly.

The system can be switched OFF in one of three ways:

- By holding down the **On/Off** button for 3 seconds, the unit will perform an automatic shutdown sequence that protects the hard disk and switches into an energy-saving standby mode.
- By holding down the **On/Off** button for more than 3 seconds, the unit will display a shutdown menu, enabling the operator to shutdown the system to standby mode or to perform a full shutdown (see Figure 3-20 on page 3-34).
- By holding down the **On/Off** button for more than 10 seconds, the unit will perform an emergency shutdown. It is not recommended to use this type of shutdown unless the application is locked and no other operation can be performed.

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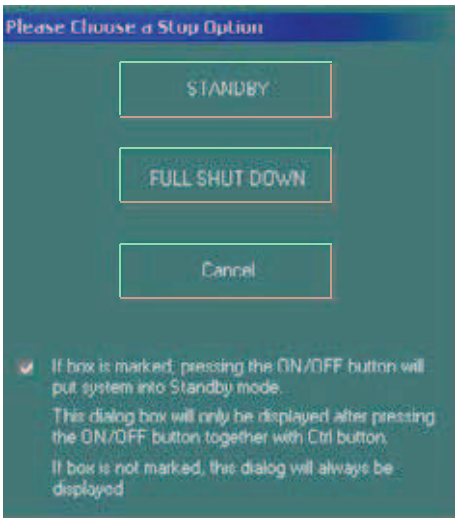
Please Choose a Stop Option
STANDBY
FULL SHUT DOWN
Cancel
If box is marked, pressing the ON/OFF button will put system into Standby mode.
This dialog box will only be displayed after pressing the ON/OFF button together with Ctrl button.
If box is not marked, this dialog will always be displayed

Figure 3-20 Shut-Down Options Screen

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Section 3-6
System Configuration

Once all the required peripherals have been installed and the unit has been switched on, configure the system settings in the *System Configuration* window tabs. Refer to the Vivid™ 3 Pro/Vivid™ 3 Expert User Manual for additional information about system configuration.

3-6-1 Adjusting the Display Monitor

The display monitor's contrast and brightness controls may need periodic adjustment due to changes in ambient light. They can be adjusted using the **Contrast** and **Brightness** buttons on the front part of the display monitor.

All display monitor controls, other than the contrast and brightness controls, are factory adjusted for optimum settings and usually do not require further adjustment.

For details on adjusting the display monitor settings, refer to the *Monitor Operation* section, on page 6-9.

3-6-2 Hospital Info Tab

1) Press **Config** on the alphanumeric keyboard. The *System Configuration* window is displayed with the **Hospital Info** tab selected, as shown below:

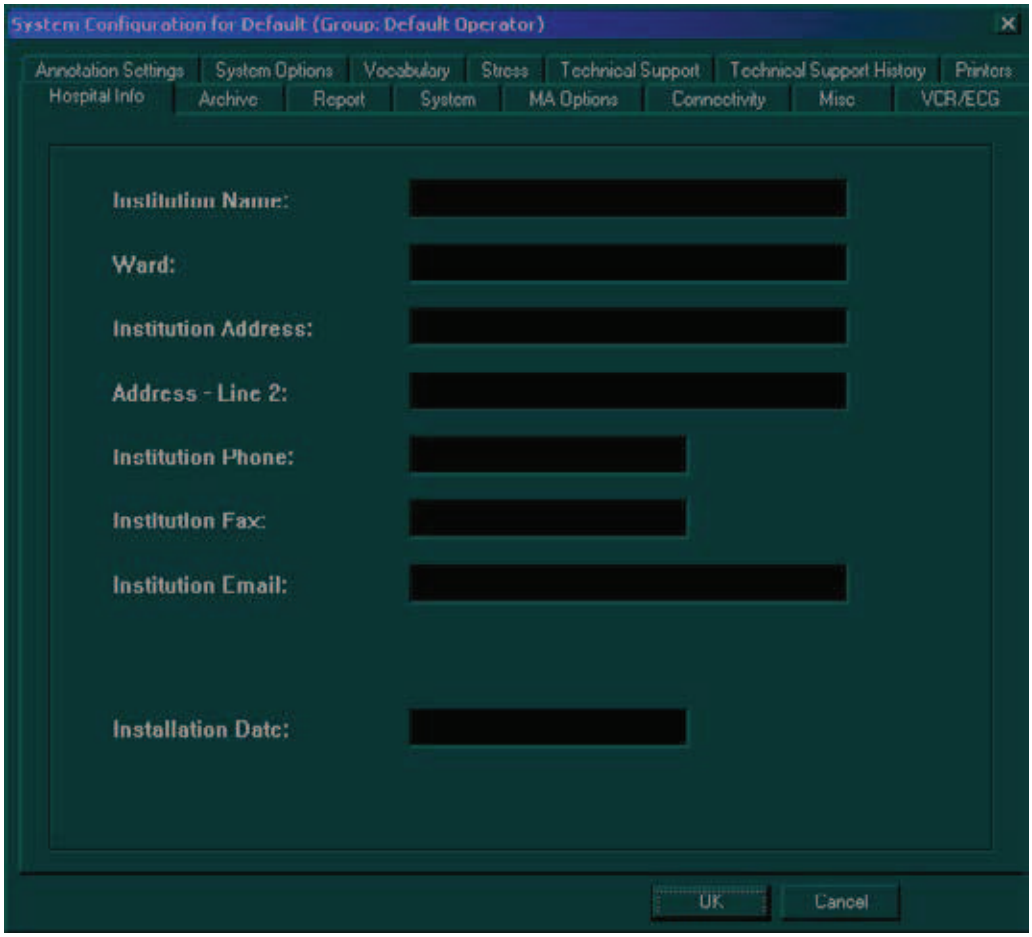

Figure 3-21 Hospital Info Tab

2) In the **Hospital Info** tab, enter the required information in the appropriate fields.

3) Trackball to the **OK** button and press **Select**.

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3-6-3 System Tab

1) Press **Config** on the alphanumeric keyboard. The *System Configuration* window is displayed.

2) Trackball to the **System** tab and press **Select**. The software information is displayed in the upper portion of the tab, as shown below:

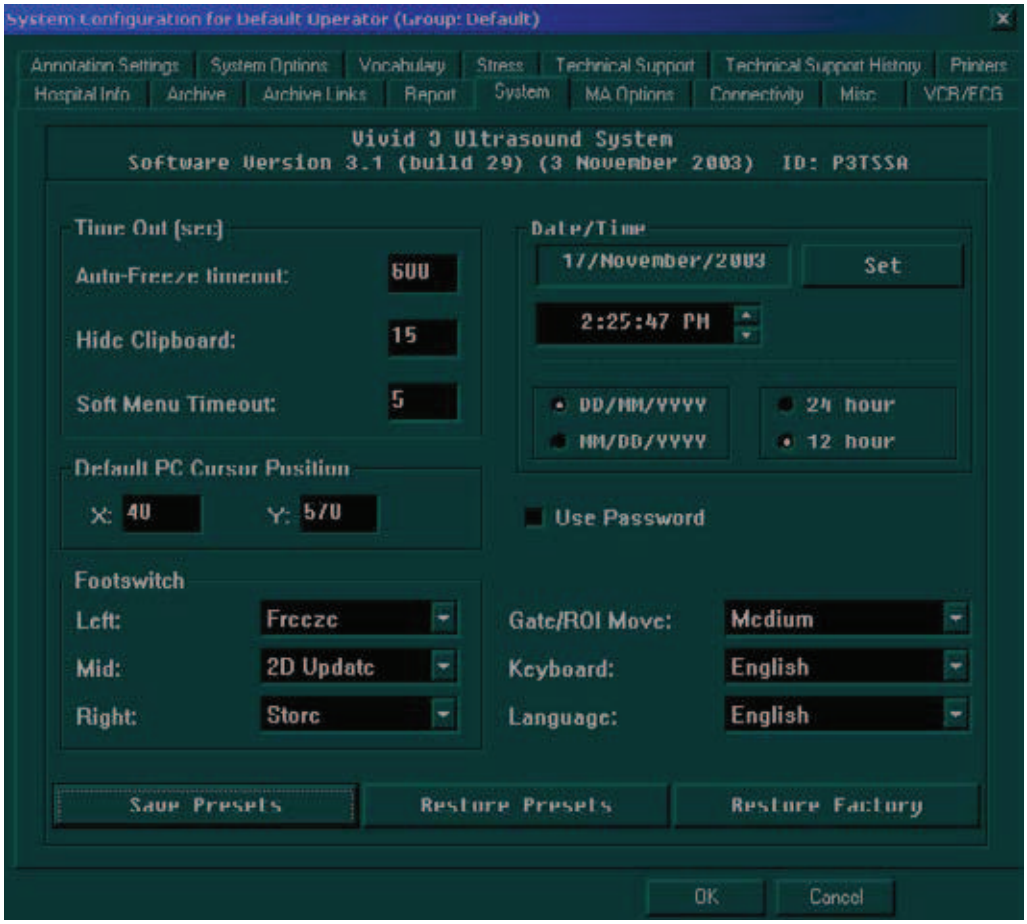

Figure 3-22 System Tab

Note: To avoid corruption of the archives, do not change the date.

3) In the **STANDBY timeout** field of the **Time Out (sec)** area, enter the amount of time (in seconds) after which the system switches to standby mode when it is not being used.

4) In the **Date/Time** area, set the date and time, as follows:

- Trackball to the **Set** button and press **Select**. Use the alphanumeric keyboard to select the current date.
- Select the format of the date and time display, for example, DD/MM/YYYY.
- Select the hour mode, for example, 24 hour or 12 hour.
- In the **Default PC Cursor Position** area, specify the default location of the PC cursor on the screen by entering the X and Y coordinates into the **X** and **Y** fields. The Figure 3-22, above indicates the recommended default factory setup for X and Y.

5) In the **Footswitch** area, define the functions that will be performed when each of the three pedals on the footswitch is used by selecting the relevant function from the **Left**, **Mid** and **Right** drop-down lists.

6) Select the system language from the **Language** dropdown list.

7) Trackball to the **OK** button and press **Select**.

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3-6-4 Connectivity Tab

For details on the **Connectivity** tab, refer to the *Connectivity Setup* section, on page 3-50.

3-6-5 Archive Tab

1) Press **Config** on the alphanumeric keyboard. The *System Configuration* window is displayed.
2) Trackball to the **Archive** tab and press **Select**. The **Archive** tab is displayed, as shown below:

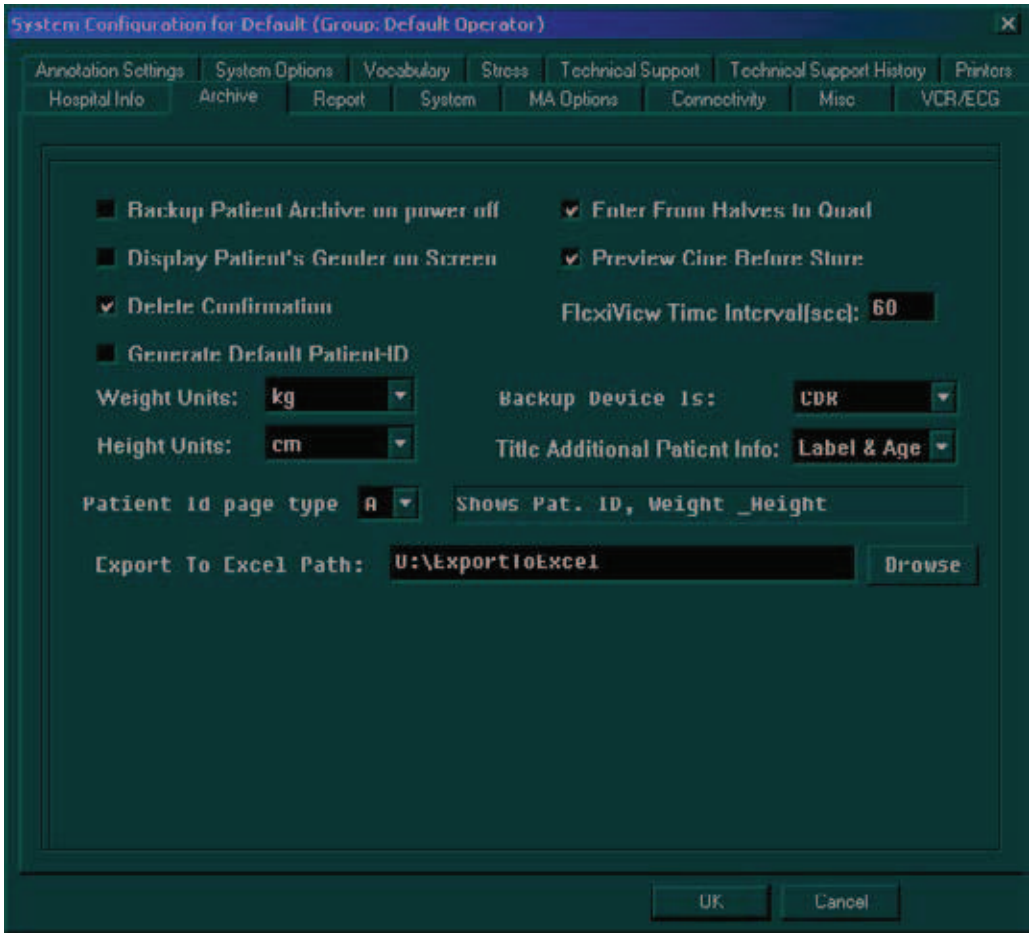

Figure 3-23 Archive Tab

Note: The **Archive** tab will display even if the Archive Package option is not installed.

3) Select **Display patients gender on screen** to display the patient's gender in the patient information area of the scanning screen (not applicable to OB applications).
4) Select **Delete Confirmation** to prompt the user to confirm delete commands.
5) Select the type of weight measurement to be used during examinations and in the *Patient Details* pages from the **Weight Units** dropdown list.
6) Select the type of height measurement to be used during examinations and in the *Patient Details* pages from the **Height Units** dropdown list.

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7) Select the patient ID page type from the **Patient ID Page Type** dropdown list, as follows:
   - **Type A:** displays patient ID, last and first name, weight, height, BSA, BP and other fields.
   - **Type B:** displays all Type A fields except patient ID.
   - **Type C:** displays all Type A fields except patient ID, weight, height and BSA. It also displays the sonographer's name.
   - **Type D:** displays all Type A fields except patient ID, weight, height, BSA and BP.
8) Select the patient data to be displayed in the patient information area of the scanning screen title bar from the **Title Additional Patient Info** dropdown list.
9) Select the type of media, to which data is stored during backup, from the **Backup Device Is** dropdown list.
10) Select **Eject MO Disk on Shutdown** to have the system automatically eject the backup media when the unit is shut down.
11) Enter the location of ASCII files in the user (U:\path\) partition of the internal hard disk in the **Export To Excel Path** field.
12) Select **Enter From Halves to Quad** to enable the user to toggle between viewing a single image, two images or four images on the screen simultaneously (Quad View).
13) Select **Preview Cine Before Store** to display cineloops before they are stored.
    - When the FlexiView option is installed the time period (in seconds) after which a cineloop is automatically stored in the archive without interrupting the user's monitoring must be set in the **FlexiView Time Interval[sec]** field. Figure 3-23 on page 3-37 indicates the recommended default factory setup.
14) Trackball to the **OK** button and press **Select**.

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3-6-6 Annotation Settings Tab

1) Press **Config** on the alphanumeric keyboard. The *System Configuration* window is displayed.

2) Trackball to the **Annotation Settings** tab and press **Select**. The **Annotation Settings** tab is displayed, as shown below:

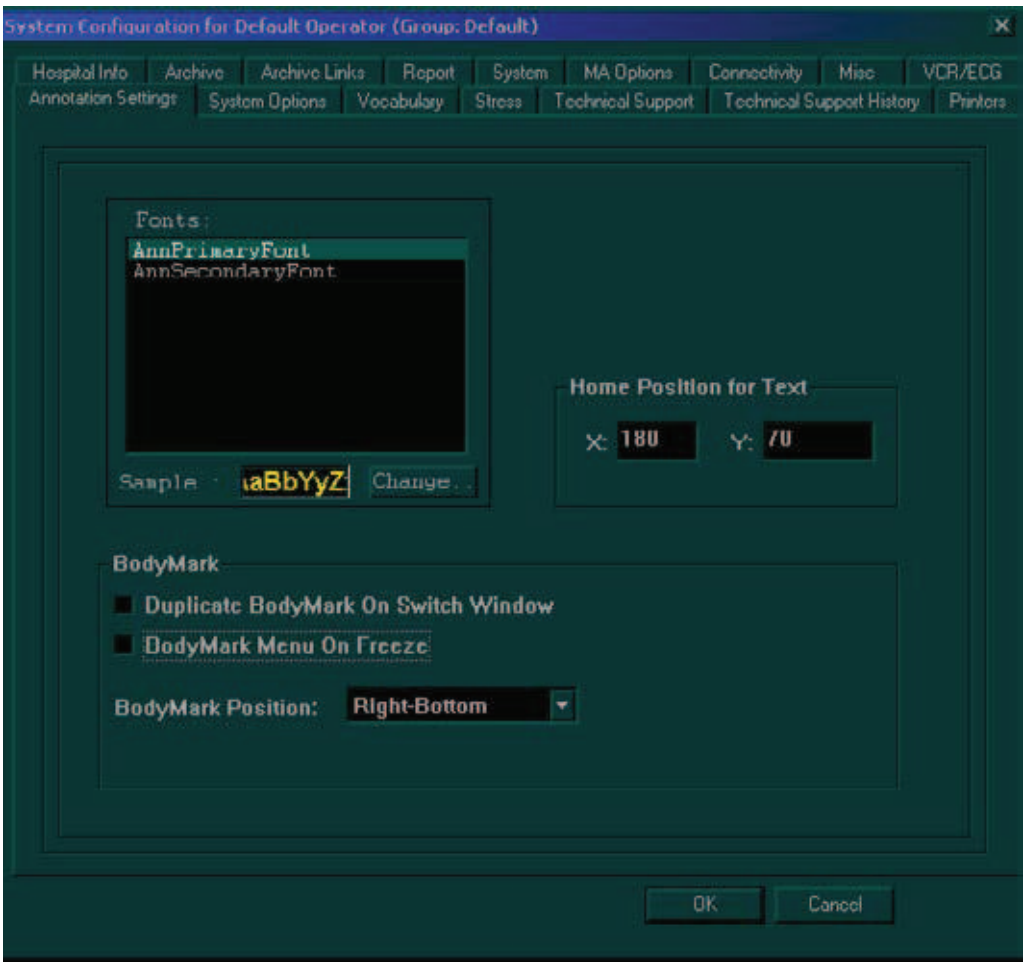

Figure 3-24 Annotation Settings Tab

3) Define the primary and secondary fonts to be used for annotations, as follows:

- Trackball to the font to be defined (**Primary** or **Secondary**) in the **Fonts** area and press **Select**. The font name is highlighted.
- Trackball to the **Change** button and press **Select**. The *Font* dialog box is displayed.
- Trackball to the required font, color, style and size and press **Select** for each choice.
- Trackball to **OK** and press **Select**. The font is defined.
- In the **Home position for text** area, set the home position for the text cursor, by entering the X and Y coordinates into the **X** and **Y** fields, as required.

Note: After setting the font type for the annotations the user can change the font type during annotation typing by pressing on the **Menu** key and selecting the required font from the drop-down list. Thereafter, additional typing will be in the newly-modified font.

4) Select the required Bodymark position from the available selections (*Left-bottom*; *Left-top*; *Right top*; *Right bottom*).

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Whenever the Bodymark is now displayed, it will appear in the newly-selected position (until such time as this setting is changed)

5.) Activate the *Duplicate Bodymark on Switch Window* and/or the *Bodymark Menu on Freeze* checkboxes, as required.

Note: For more details on using the Bodymark features, refer to the *Vivid™ 3 User Manual.*

6) Trackball to the **OK** button and press **Select**.

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3-6-7 System Options Tab

1) Press **Config** on the alphanumeric keyboard. The *System Configuration* window is displayed.
2) Trackball to the **System Options** tab and press **Select**. The **System Options** tab is displayed, as shown below:

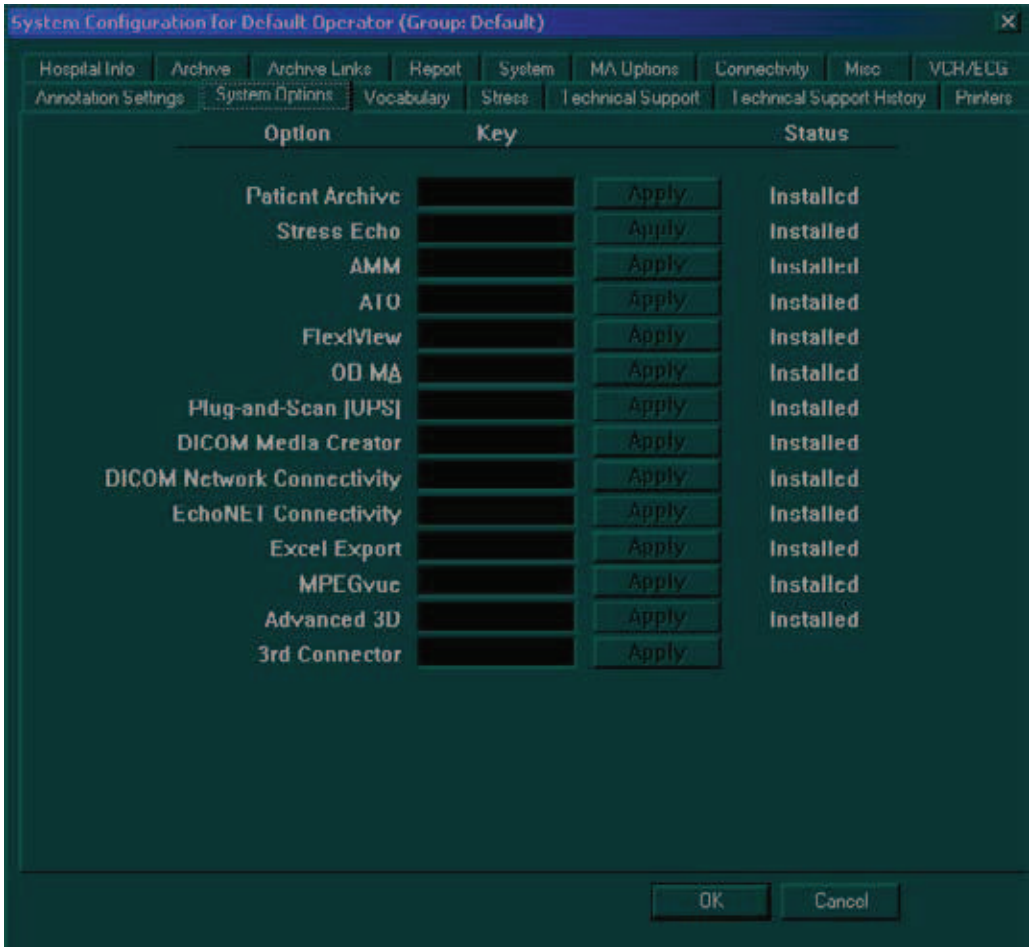

Figure 3-25 System Options Tab

Note: If an option is not available for the specific ultrasound unit, the option name and **Key** field is disabled (grey).

3) Trackball to the **Key** field next to the name of the option being installed, and use the alphanumeric keyboard to enter the password supplied by GE.

Note: If an incorrect password is entered, if the option has already been correctly installed in the system, it will be removed.

Note: Please note that all passwords should be visible underneath the control console or/and on the green password (option) certificate. If a new password (option) is required, contact the GE representative to initiate the appropriate process, so that the relevant password (option) will be installed on the system.

4) Trackball to **Apply** and press **Select**. The status of the option changes to **Installed**.
5) Repeat steps 3 and 4 as required.
6) Trackball to the **OK** button and press **Select**.

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Note: If an option was not initially purchased or installed, it may be acquired and/or installed later. During option installation, type the relevant password in the appropriate Option window (see Figure 3-25) and click **Apply**. The **Installed** status (to the right of the Apply button) will then be visible.

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3-6-8 Printers Tab

1) Press **Config** on the alphanumeric keyboard. The *System Configuration* window is displayed.
2) Trackball to the **Printers** tab and press **Select**. The **Printers** tab is displayed, as shown below:

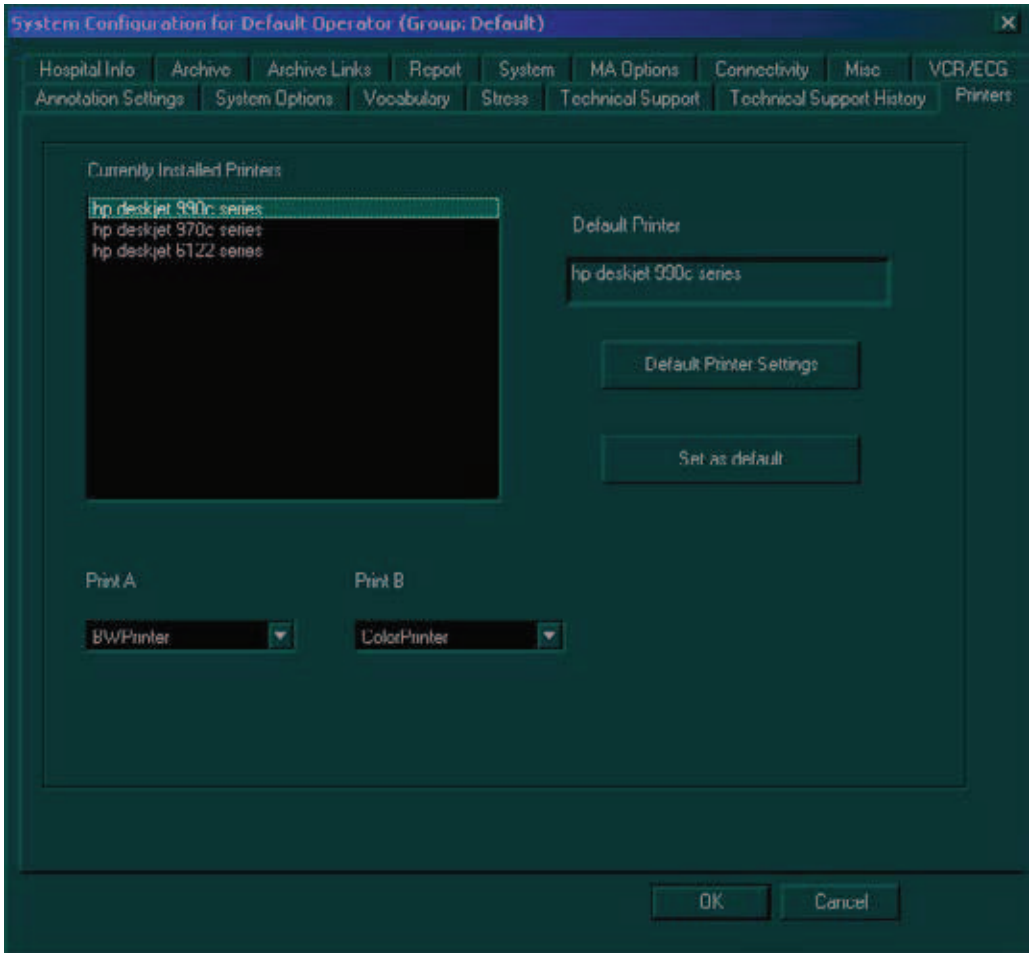

Figure 3-26 Printers Tab

Note: Please note, the printers indicated in the *Currently Installed Printers* field, are the recommended and approved printers to be used with the Vivid™ 3 system. Other generic printers are not approved, and GE Medical Systems will not guarantee their correct operation on this system.

3) In the **Currently Installed Printers** area, trackball to the required printer and press **Select**. The printer is highlighted.
4) Trackball to the **Set as default** button and press **Select**. The selected printer is set as the default printer and is shown in the text box above the option buttons.

Note: If required, two printers may be configured for use with the system (for example, one color, one black & white), by selecting the required options under each of two drop-down lists (labelled *Print A* and *Print B*, respectively) as shown in the following steps:

5) TRACKBALL to the **Print A** combo box (in the lower *left* area of the screen) choose the required printer and press **Select**. (In the example below, *BW Printer* is selected).

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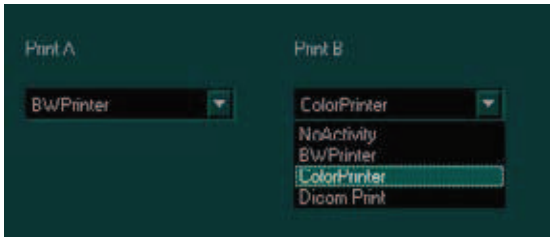

6) Trackball to the **Print B** combo box, choose the required printer and press **Select**. (In this example, Color Printer is selected).

7) Trackball to the **OK** button and press **Select**.

Note: To test that printer configuration is satisfactory, verify that paper has been loaded and that the ink cartridge is installed. Select any report and try to print it, verify that printing quality and information is satisfactory.

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3-6-9 VCR/ECG Tab

1) Press **Config** on the alphanumeric keyboard. The *System Configuration* window is displayed.
2) Trackball to the **VCR/ECG** tab and press **Select**. The **VCR/ECG** tab is displayed, as shown below:

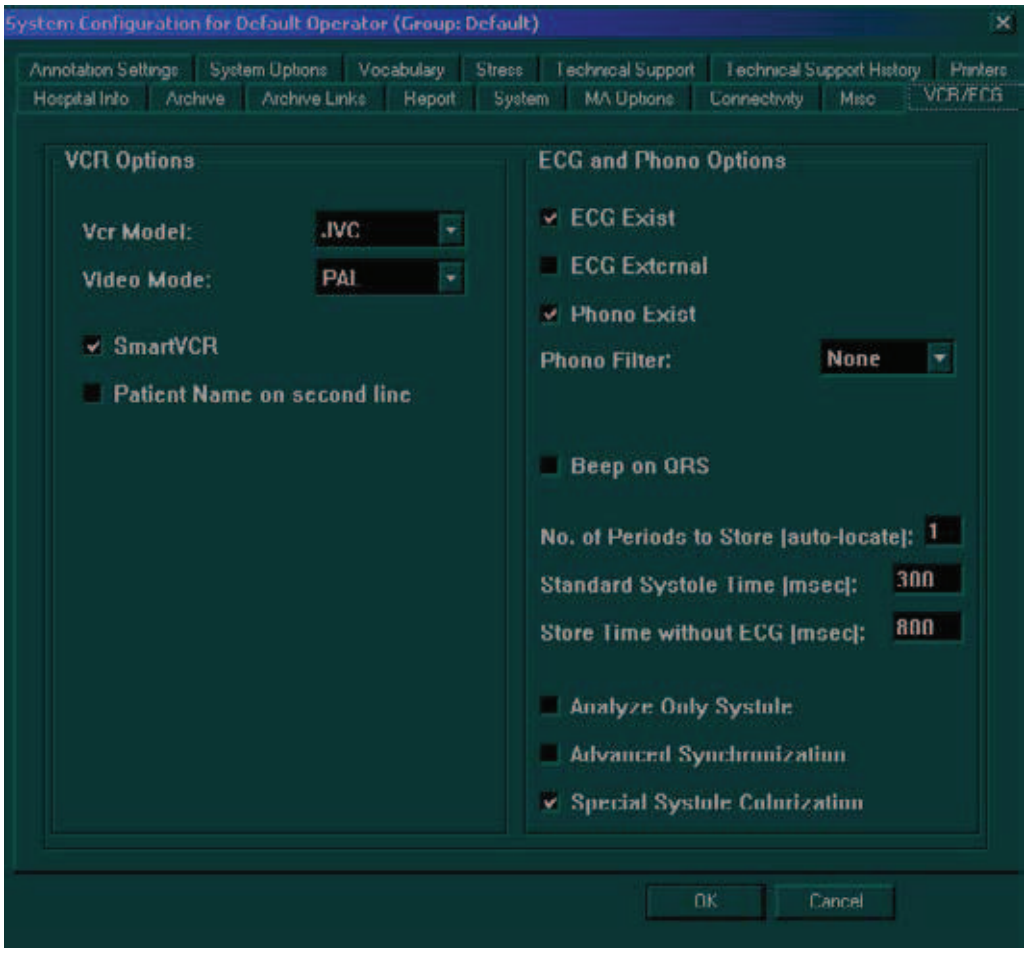

Figure 3-27 VCR/ECG Tab

3) In the **VCR Options** area, complete the following, as required:
   - Select the appropriate VCR from the **VCR Model** dropdown list, for example, *Sony*, *JVC*, or *Panasonic*.
   - Select the video system from the **Video Mode** dropdown list, for example, PAL or NTSC.
   - Select the **SmartVCR** option to enable Measurement and Analysis measurements and calculations on recorded VCR images.
   - Select the **Patient Name on second line** option to display the patient's name on the second line. For use when an external monitor omits picture borders.
4) If done, trackball to the **OK** button and press **Select**.

Note: To test the VCR option, insert a video cassette. Refer to the *Peripherals* section, on page 4-4.

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5) In the **ECG and Phono Options** area, complete the following, as required:

- Select each connected option including, **ECG Exist**, **ECG External**, **Phono Exist** and/or **Phono Filter**.
- In the **No. of Periods to Store (auto-locate)** field, enter the number of heart cycles (1-4) of the frozen image that will be displayed in the multiple screen/split screen when in freeze mode.
- In the **Standard Systole Time (msec)** field, enter the default systole time, which enables cineloop synchronization.
- In the **Store time without ECG (msec)** field, define the default length of a cineloop when there is no ECG trace.
- Select the **Analyze only Systole** checkbox to place markers only on the systole portion, for synchronization and analysis purposes.
- Select the **Advanced Synchronization** checkbox to enable the use of a special synchronization algorithm. This algorithm allows non-linear stretching of the time base to compensate for non-linearity of the heart cycle between the resting HR and elevated HR.
- Select the **Special Systole Colorization** checkbox to enable the function of systole and diastole colorization, if required. This function will present the systolic ECG signal in a different color from that of the diastolic ECG signal.

Note: The default factory setups are seen in Figure 3-27 on page 3-45. However, the user may want to set different values and presets.

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3-6-10 Technical Support Tab

The System Configuration *Technical Support* tab is used when new hardware has been installed, or when it necessary to enable new functionality. The appearance of the Technical Support tab differs in accordance with the specific Vivid™ 4 BT03 model (RFI or RFT configuration), as described below.

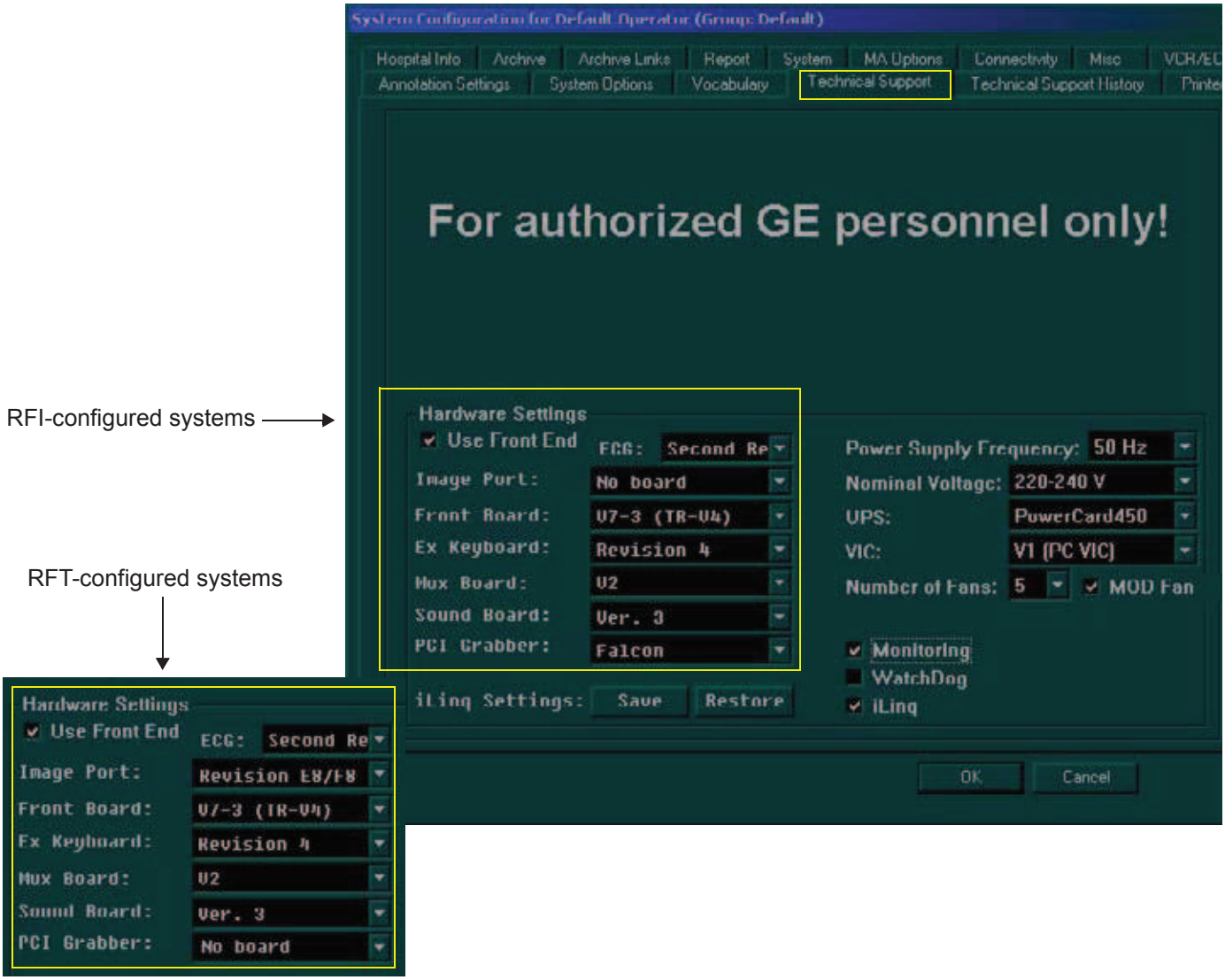

Figure 3-28 Technical Support Tab

Monitoring - should *always* be enabled (this provides constant monitoring of critical parameters to ensure safe operation of the system).

Watchdog - normally should not be enabled. When enabled, if there is a system lock-up caused by the Back End, this will turn OFF power at the Front End.

MOD Fan - should be enabled only on BEPs based on Pentium IV - this provides faster operation of the MOD. Enabling this option in the wrong type of BEP may cause damage to the MOD or MO media.

Use Front End - normally should be enabled.

ILinq - should be enabled only on systems that use the iLinq option.

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Table 3-17 Recommended Vivid™ 3 Hardware Configurations - RFI Models

Item	BT03 Vivid™ 3
ECG	Second Re
Image Port	No board
Front Board	V7-3 (TR-V4) or V7-2 (TR-V4
Ex Keyboard	Revision 4
MUX Board	V2
Sound Board	Ver. 3
PCI (Frame) Grabber	Falcon
Network Board	Intel EtherExpr
UPS	PowerCard 450
VIC	V1 (PC VIC)
Number of Fans	5

Table 3-18 Recommended Vivid™ 3 Hardware Configurations - RFT Models

Item	BT03 Vivid™ 3	BT03 Pro
ECG	Second Re	Second Re
Image Port	Revision E8/F8	Revision E8/F8
Front Board	V7-3 (TR-V4) or V7-2 (TR-V4	V7-3 (TR-V4) or V7-2 (TR-V4)
Ex Keyboard	Revision 4	Revision 4
MUX Board	V2	V2
Sound Board	Ver. 3	Ver. 3
PCI (Frame) Grabber	No board	No board
SCSI Board	AHA-29160N	AHA-29160N
Network Board	Intel EtherExpr	Intel EtherExpr
UPS[a]	PowerCard 450	PowerCard 450
VIC	V1 (PC VIC)[b]	V1 (PC VIC)[b]
Number of Fans	5	5

a. optional
b. valid only for Pentium 4; when a machine is based on Pentium III, use V0 (external).

Note: When a system's Back End is upgraded to Pentium 4, in future the BEP should only be replaced with a Pentium 4-type BEP. See *Chapter 8 - Replacement Procedures* and *Chapter 9 - Renewal Parts* for more details.

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3-6-11 Technical Support History Tab

The Technical Support History is where you would record any historical technical support information that may be relevant to a problem, or any other maintenance operations performed.

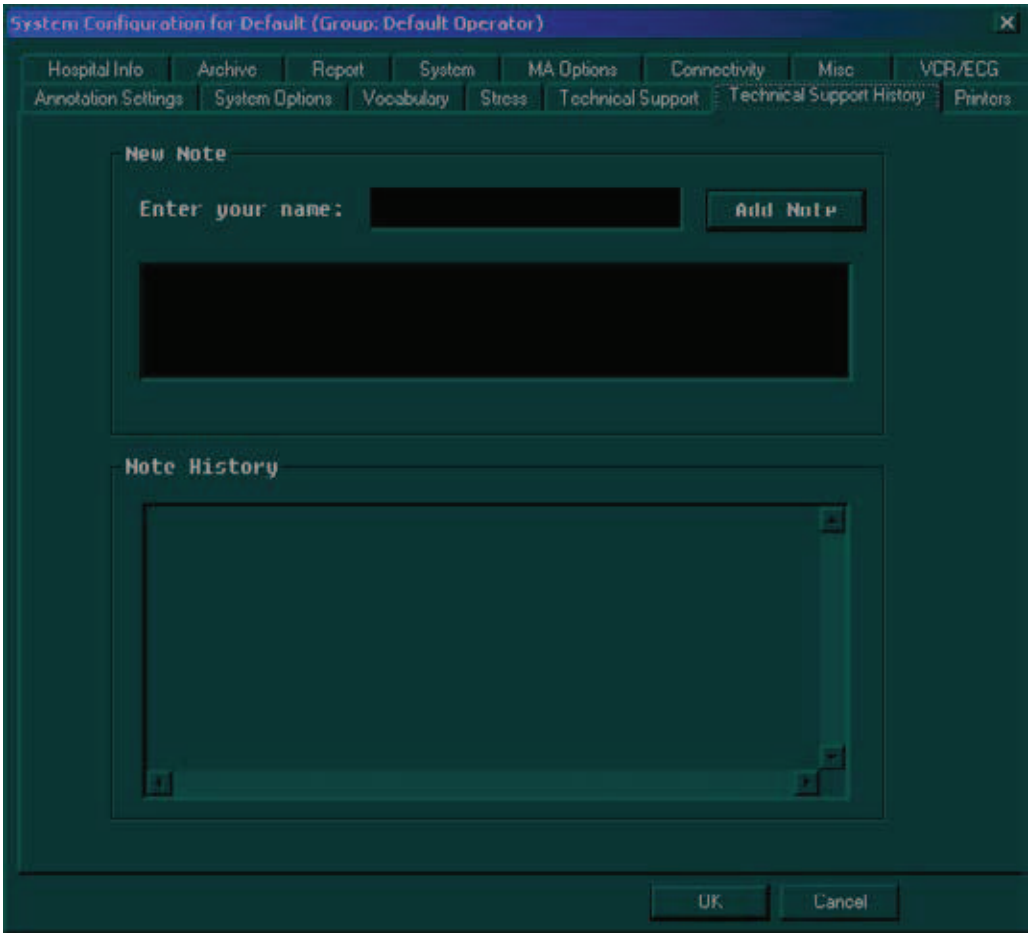

Figure 3-29 Technical Support History Tab

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Section 3-7
Connectivity Setup

3-7-1 Introduction

The Vivid™ 3 ultrasound unit can be connected to various connectivity devices, such as DICOM devices and EchoPac servers. The following sections describe how to connect the system to a remote archive/work station or a DICOM service, using a TCP/IP connection.

3-7-2 Physical Connection

3-7-2-1 Ethernet Switch Connections

An Ethernet Switch (P/N: 066E0741), is used to connect the Vivid™ 3 system to an EchoPAC PC and a network printer.

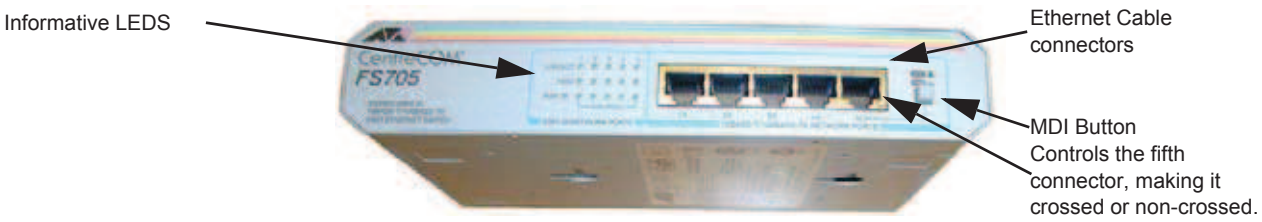
Informative LEDS
FS705
Ethernet Cable connectors
MDI Button Controls the fifth connector, making it crossed or non-crossed.

Figure 3-30 Ethernet Switch Identifications

Table 3-19 MDI Button Position Descriptions

Position	Label	Function
	X To PC	To connect an end station or a Server to the Port
	= To HUB	To connect a HUB or another Switch to the Port

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3-7-2-2 Local Network Connection to EchoPAC PC Workstation

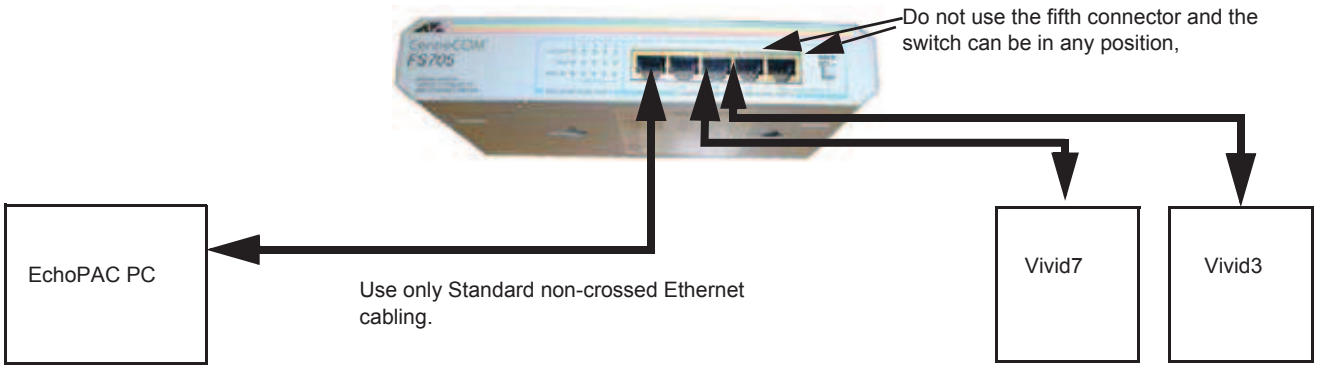
Do not use the fifth connector and the switch can be in any position,
EchoPAC PC
Use only Standard non-crossed Ethernet cabling.
Vivid7
Vivid3

Figure 3-31 Local Network Connection

3-7-2-3 Hospital Network Connection to EchoPAC PC Workstation

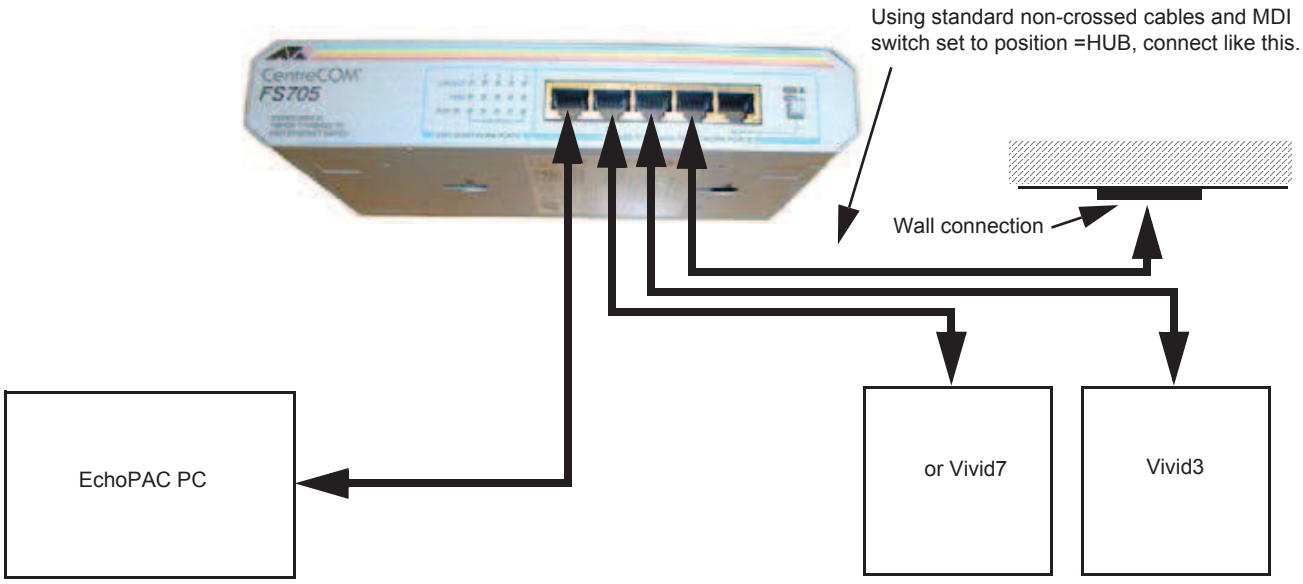
Using standard non-crossed cables and MDI switch set to position =HUB, connect like this.
Wall connection
EchoPAC PC
or Vivid7
Vivid3

Figure 3-32 Hospital Network Connections

See the EchoPAC PC Service Manual (Part Number EP091298) for details about the EchoPAC PC, and the required set-up procedures.

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3-7-3 Setting Up for Connectivity

Notes:

- Four passwords are required to complete the setup of the connectivity options. Ensure that all these passwords are installed on the Vivid™ 3 ultrasound unit before you begin the configuration procedure.
- The 3rd Connector option is available for use with Vivid™ 3 BT03 systems.
- The HL7 option (not listed) is a licence granting permission to connect the system to the HL7 gateway, through the EchoPAC. This function (which is configured on EchoPAC, not on the Vivid™ 3 system) is used to export examination results to the Hospital Information System (HIS), through HL7 protocol. Users requiring this option should contact the GE representative.

1) Press **Config** on the alphanumeric keyboard. The *System Configuration* window is displayed.
2) Trackball to the **System Options** tab and press **Select**. The **System Options** tab is displayed, as shown below:

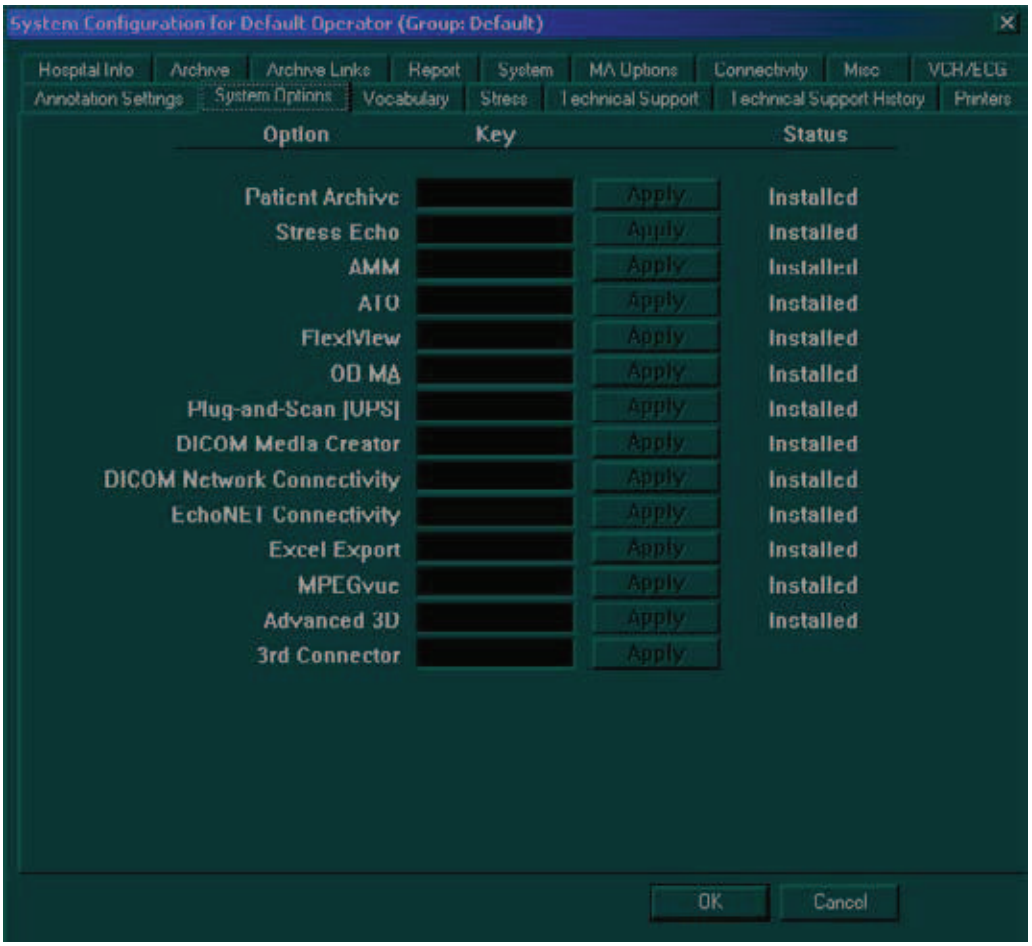

Figure 3-33 System Options Tab

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3) Verify that the following options are installed, as required:
   - **DICOM Media Creator** is required to support DICOM storage to MOD or CD-R media.
   - **DICOM Network Connectivity** is required to support DICOM storage over the network, for example, to Proslov.
   - **EchoNET Connectivity** is required to support an EchoPAC direct connection.
   - **Excel Export** is required to support the ability to export measurements and reports to Microsoft Excel files.
4) Enable the **DICOM printer** option, as required (under the *Services* sub-tab) - see Figure 3-34.

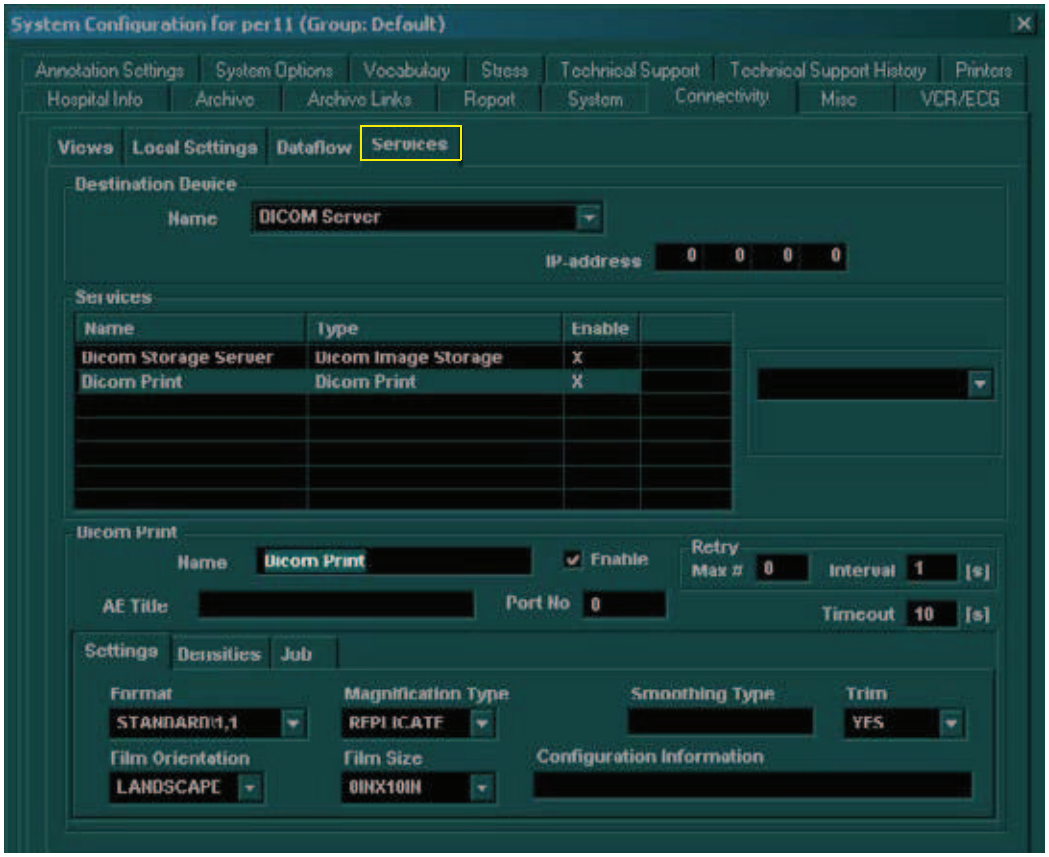

Figure 3-34 Setting up DICOM Print

5) Enable any other remote server, as required (for example, Services, My Computer, select **MPEGvueCDR** as shown in Figure 3-35).

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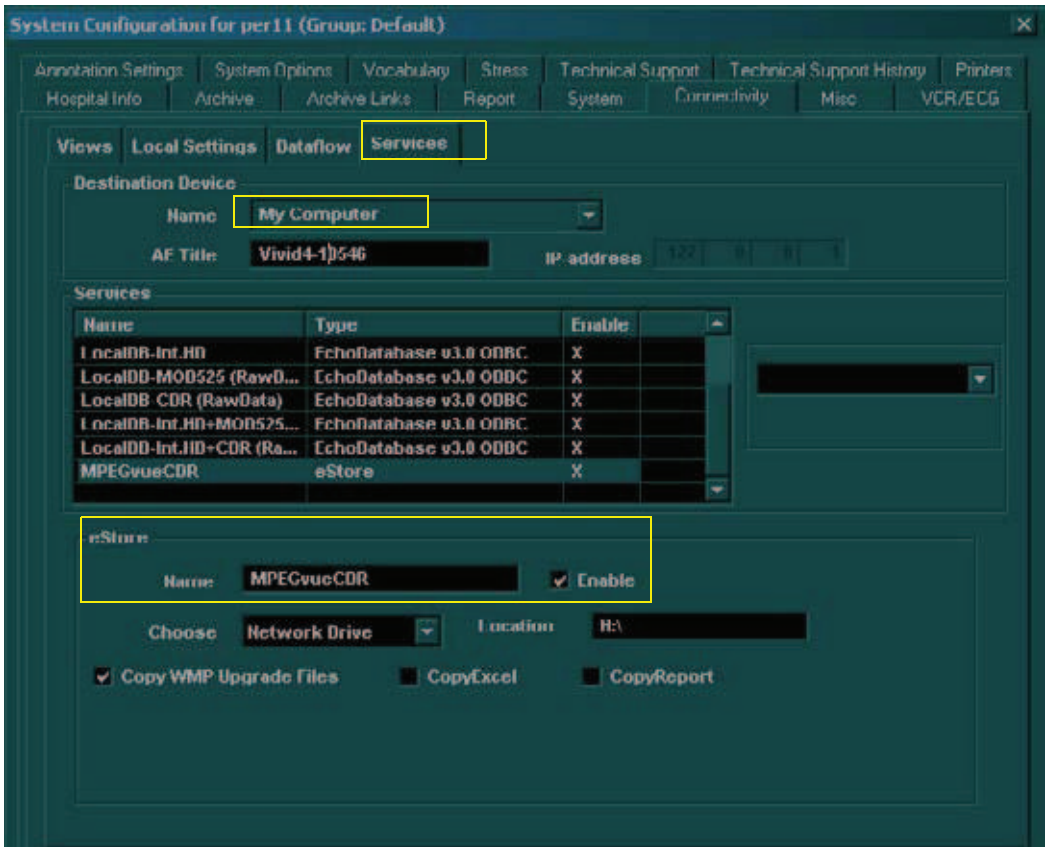

Figure 3-35 Setting up Remote Server for MPEGvue

6) When done, trackball to the **OK** button and press **Select**.

7) Trackball to the **OK** button and press **Select**.

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3-7-4 Setting Up the Network Connection

1) Press **Config** on the alphanumeric keyboard. The *System Configuration* window is displayed.

2) Trackball to the **Connectivity** tab and press **Select**. The **Connectivity** tab is displayed, with the **Views** subsidiary tab selected by default, as shown below:

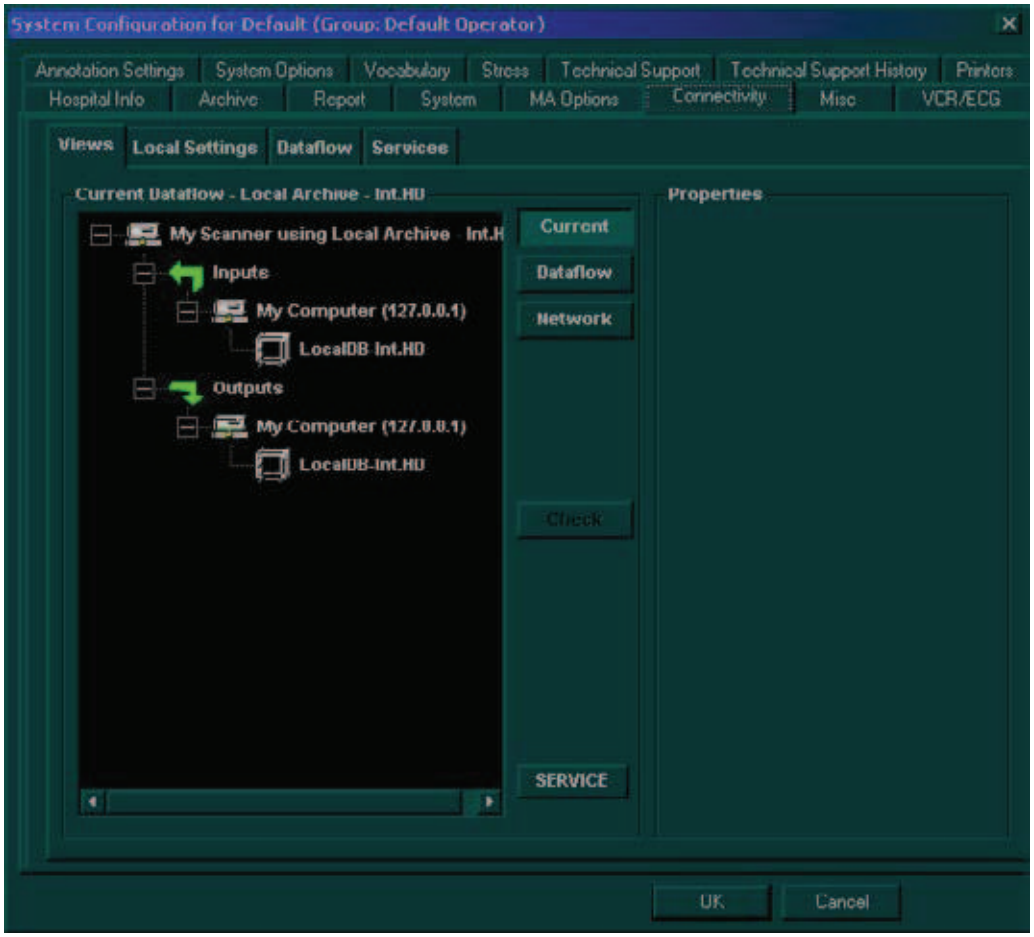

Figure 3-36 Connectivity Tab

3) Trackball to the **SERVICE** button at the bottom of the **Views** tab, and press **Select**. The following dialog box is displayed:

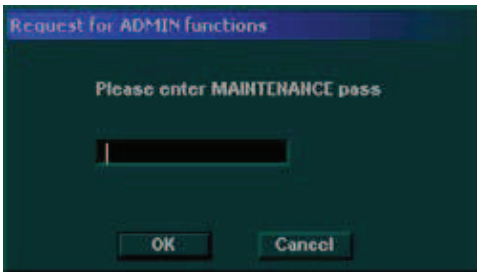

Figure 3-37 Password Request Dialog Box

4) Enter the password **geulsservice**, and then trackball to the **OK** button and press **Select**.

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5) Trackball to the **Local Settings** tab and press **Select**. The **Local Settings** tab is displayed, as shown below.

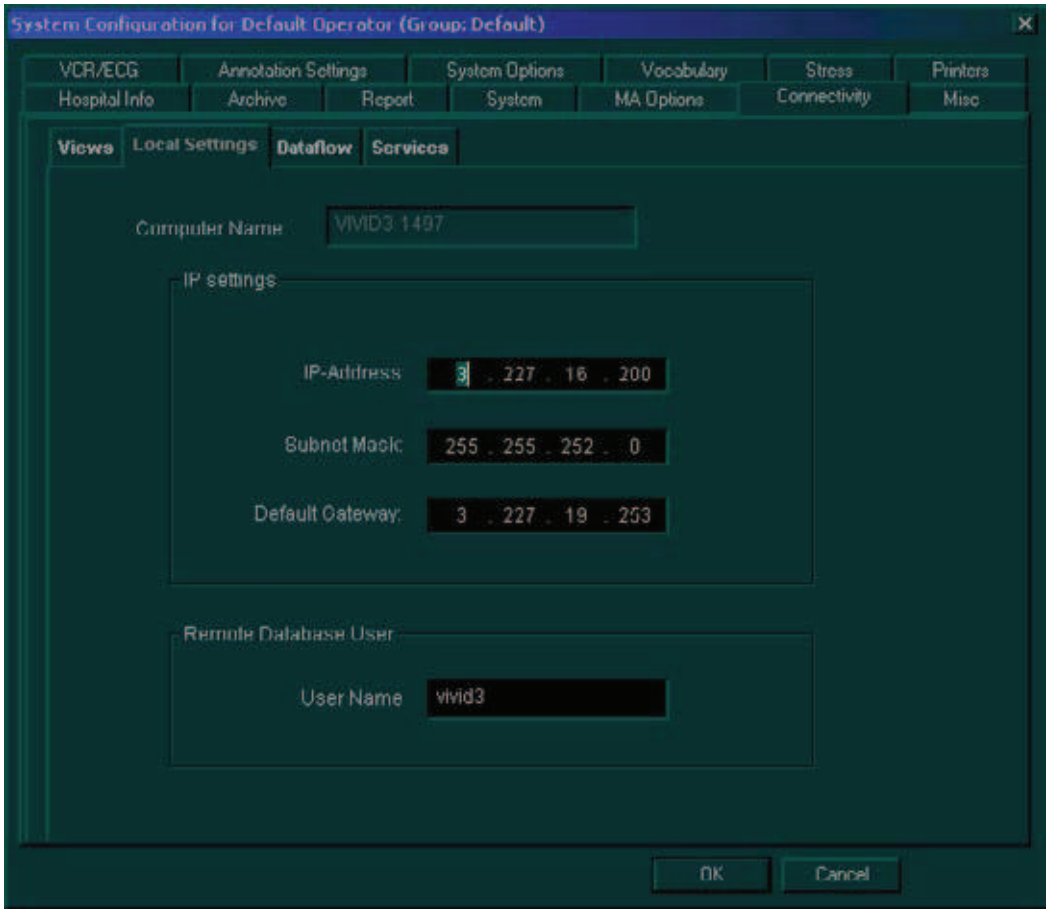


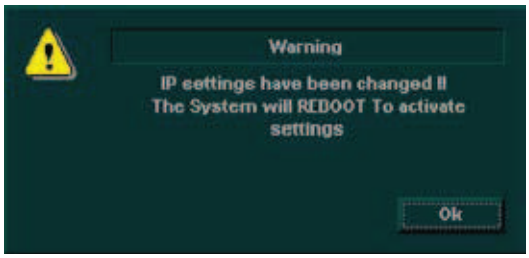
Figure 3-38 Local Settings Tab

Note: The *Computer Name* field shows the serial number of your Vivid™ 3 system.

6) Enter the network information in the appropriate fields. Leave the **User Name** as **vivid3**.

Note: The **Default Gateway** option is not always required. If this address is not supplied by the system administrator, leave it blank.

7) Trackball to the **OK** button and press **Select**. The following warning is displayed:



8) Trackball to the **OK** button and press **Select**. The system will reboot to activate the settings.

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3-7-5 Setting Up for Communication with a Prosolv Workstation

The Vivid™ 3 ultrasound unit can connect to a Prosolv DICOM viewer through a DICOM server. The unit cannot connect directly to the viewer.

1) Setup the network connection, as described in the the *Setting Up the Network Connection* section, on page 3-55.
2) Press **Config** on the alphanumeric keyboard. The *System Configuration* window is displayed.
3) Trackball to the **Connectivity** tab and press **Select**. The **Connectivity** tab is displayed, with the **Views** subsidiary tab selected by default, as shown in Figure 3-36 on page 3-55.
4) Trackball to the **SERVICE** button at the bottom of the **Views** tab, and press **Select**. The password request dialog box (shown in Figure 3-37 on page 3-55) is displayed.
5) Enter the password **geulsservice**, and then trackball to the **OK** button and press **Select**.
6) Trackball to the **Services** tab and press **Select**. The **Services** tab is displayed, as shown below:

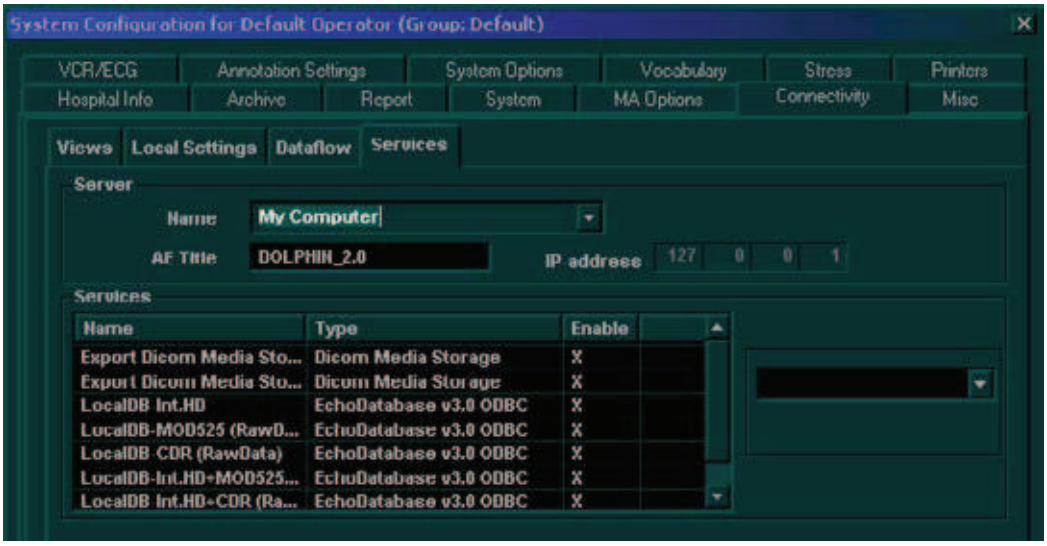

Figure 3-39 Services Tab

7) Select **DICOM Server** from the **Name** dropdown list. The **Services** tab is updated, as shown below

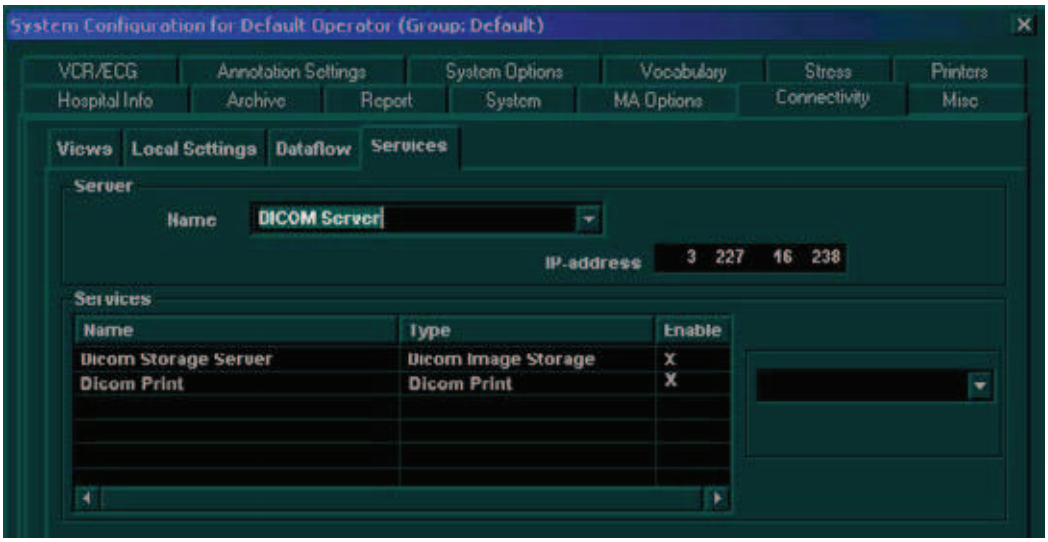

Figure 3-40 Services for DICOM Server

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8) Enter the IP address for the DICOM server in the **IP-address** field.

9) Trackball to the **Dicom Storage Server** line in the **Services** table. The **Services** tab is expanded, as shown below:

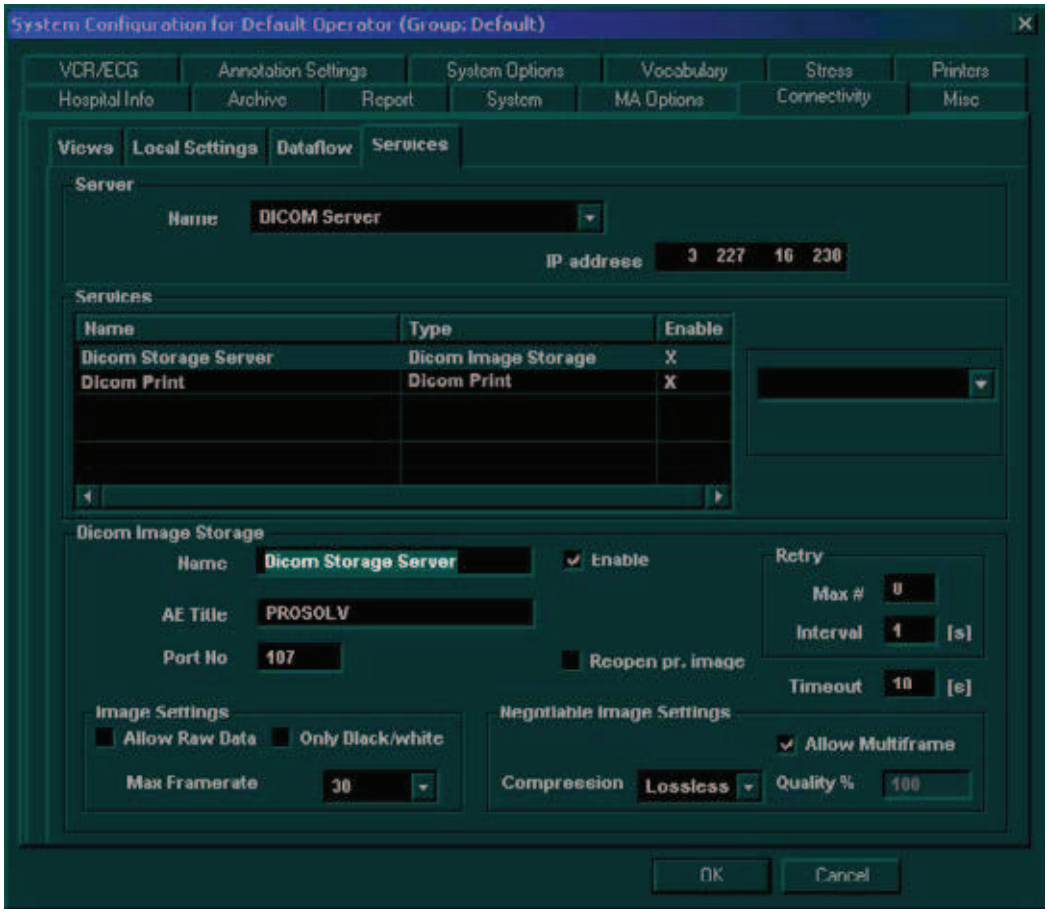

Figure 3-41 Connectivity Tab (Services for DICOM Server Expanded)

10) Enter the **AE Title** and the **Port No** of the DICOM server in the appropriate fields.

Note: Ensure that the **Allow Raw Data** checkbox is *deselected*.

11) Trackball to the **Dicom Print** line in the **Services** table. The **Services** tab is expanded, as shown in Figure 3-42 below.

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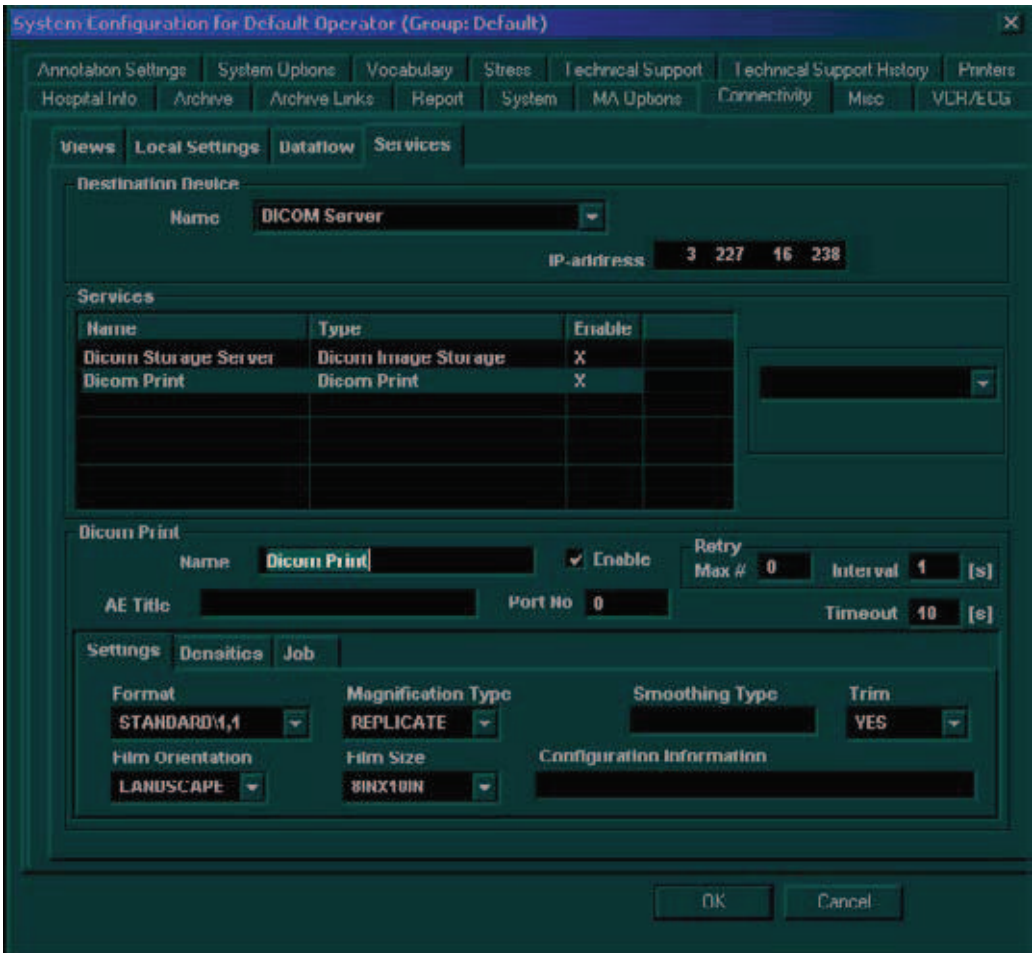

Figure 3-42 Connectivity Tab (Services for DICOM Print Expanded)

12) Under *Settings*, select the required **Format**, **Film Orientation**, etc.

13.) Proceed to the next section, to perform the procedure for validating communication with the DICOM server.

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3-7-5-1 Validating Communication with the DICOM Server

1) Trackball to the **Views** tab and press **Select**. The **Views** tab is displayed.

2) Trackball to the **Dataflow** button and press **Select**. The full list of data flows is displayed:

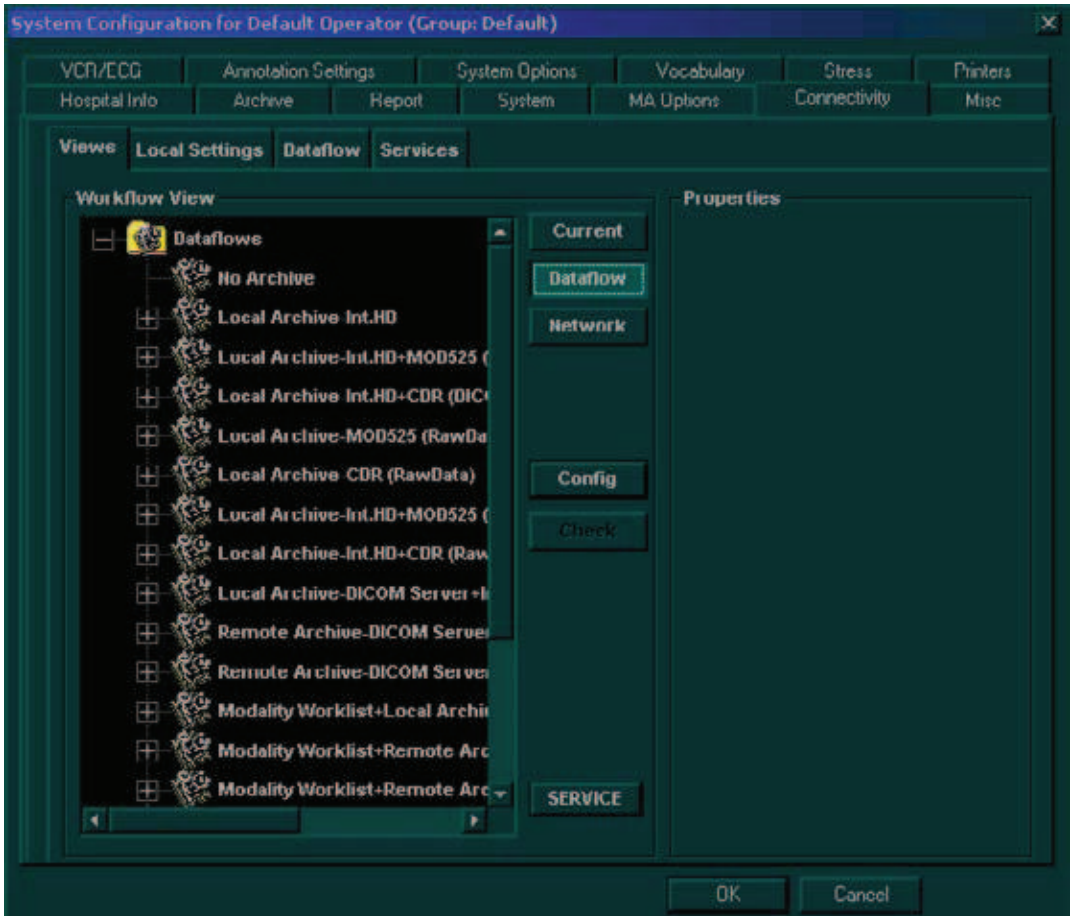

Figure 3-43 Views Tab

NOTE: ***IMPORTANT INFORMATION ABOUT DATAFLOWS****:*
The system's default dataflow is ***Local Archive - Int. HD****. In this configuration, the Patient List is in the local archive and the images are stored on the internal hard drive.*
In a dataflow configuration such as ***Int. HD - MOD 525 (DICOM)****, images are stored both on the internal hard drive and on media (MOD). The name DICOM is shown in parenthesis, signifying that on the MOD, the images are in DICOM format.*
No Archive *is a dataflow that has no output source, for use in emergencies.*

CAUTION: ***DO NOT change the name of an existing dataflow or attempt to add new services to a dataflow!*** **In the event that any changes or additions are required, contact the On-line Center.**

3) Expand the **Local Archive-Int. HD + DICOM Server** branch. The service DICOM Server is displayed.

4) Trackball to **DICOM Server** and press **Select**, then trackball to the **Check** button and press select.

- If the connection is established, a green checkmark is displayed.
- If the connection cannot be established, a red cross is displayed.

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5) If the connection was successfully established, trackball to the **Dicom Storage Server** line and press **Select**, then trackball to the **Check** button and press **Select**.
   - If the connection is established, a green checkmark is displayed.
   - If the connection cannot be established, a red cross is displayed.

   Properties of the DICOM storage server configuration are displayed on the right side of the tab, as reference.

6) If the connection was successfully established, trackball to the **Dicom Print** line and press **Select**, then trackball to the **Check** button and press **Select**.
   - If the connection is established, a green checkmark is displayed.
   - If the connection cannot be established, a red cross is displayed.

7) If all connections were established successfully, click **OK** to exit the configuration procedure. If not, review the entire procedure to locate the error.

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3-7-5-2 Validating Communication with the Workstation

1) Press the **Archive** button on the control panel. The *Patient List* window is displayed, as shown below:

Figure 3-44 Patient List Window

2) Select the **Local Archive-Int. HD + DICOM Server** option from the drop-down list at the bottom of the window. If the system will not accept the dataflow, or displays an error message, there is an error in dataflow communication.

3) Begin an exam for a new patient and store some images. The storage process will take longer as each loop is now stored in both raw data and DICOM format.

4) Begin an exam for a new patient. Once the second patient is active, the first patient's exam is closed and sent to the spooler to be sent over the network.

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5) Press **<Ctrl+S>** to view the status of the spooler, as shown below:

Figure 3-45 Job Spooler

The **Status** column can contain the following options:

- **Hold**: Images are in the spooler buffer but transmission has not begun as the exam is active.
- **Active**: Images are being transmitted over the network.
- **Done**: Transmission is complete and all the images have been transmitted over the network.
- **Fail**: Transmission failed or is incomplete. An error message will be displayed in the **Error** column.

3-7-6 Connecting Directly to EchoPAC

Note: The EchoPAC station will reject any images that have a future date. Ensure that the clock on the Vivid™ 3 ultrasound unit lags behind that of the EchoPAC system by a minute or two.

1) Press **Config** on the alphanumeric keyboard. The *System Configuration* window is displayed.
2) Trackball to the **Connectivity** tab and press **Select**. The **Connectivity** tab is displayed, with the **Views** subsidiary tab selected by default, as shown in Figure 3-36 on page 3-55.
3) Trackball to the **Dataflow** button and press **Select**. The full list of data flows is displayed, as shown in Figure 3-43 on page 3-60.
4) Expand the **Remote Archive - Remote Storage** branch. A service called **Remote Servers** is displayed.
5) Expand the **Remote Servers** branch. A service called **Remote Archive - Remote Storage** is displayed.
6) Trackball to the **Services** tab and press **Select**. The **Services** tab is displayed, as shown in Figure 3-39 on page 3-57.

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7) Select the EchoPAC server from the **Name** dropdown list. The **Services** tab is updated, as shown below:

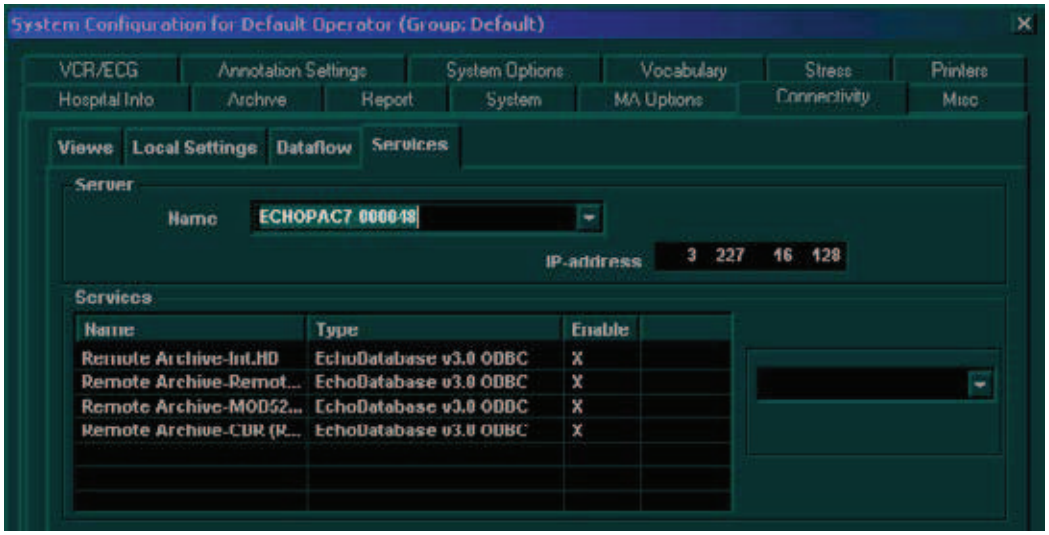

Figure 3-46 Services Tab - EchoPAC

8) Enter the IP address of the EchoPAC server in the **IP-address** field.

9) Select the **Remote Archive - Remote Storage** line from the **Services** table. The **Services** tab is expanded, as shown below:

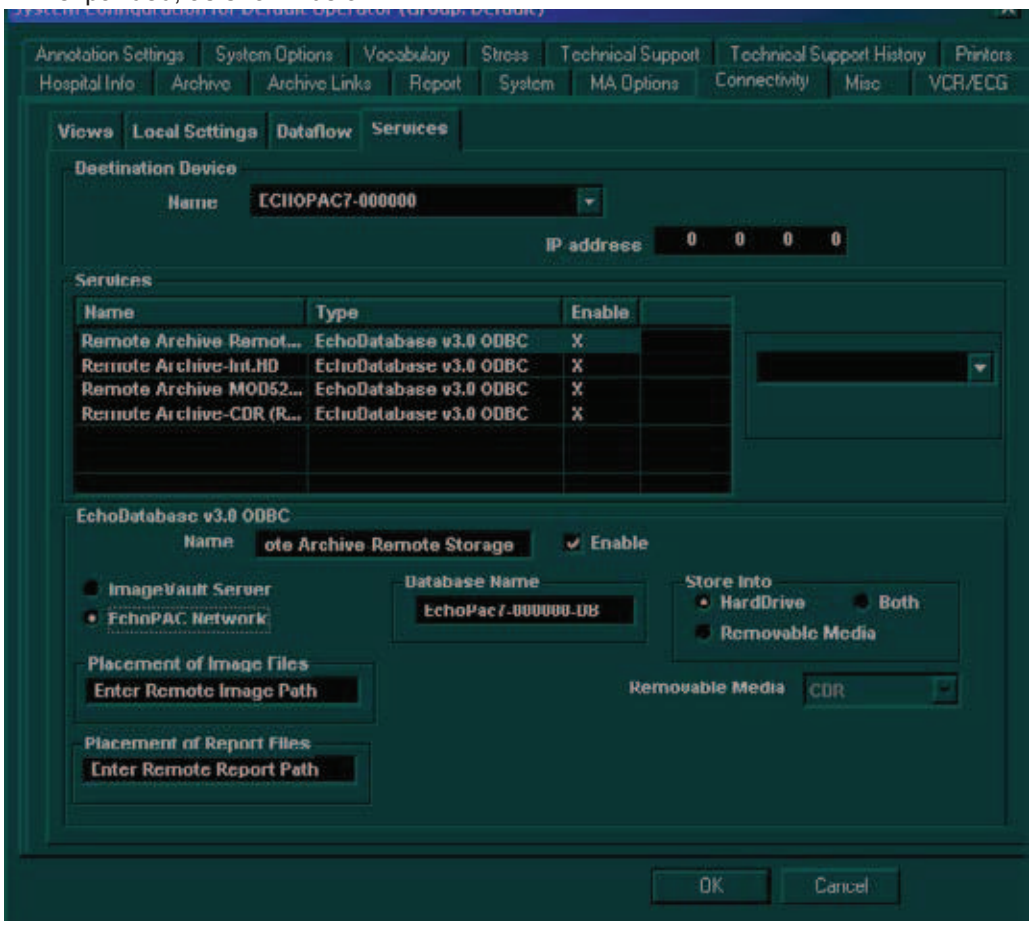

Figure 3-47 Services Tab - EchoPAC Expanded

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10) If *EchoPAC Network* is required, make sure that the **EchoPAC Network** checkbox is *selected*, as shown in Figure 3-47, above, then proceed as follows:

a.) Enter **ECHOPAC7-OOOXXX-DB** in the **Database Name** field.

b.) Under *Store Info*, select the appropriate checkbox **Hard Drive, Removable Media**, or **Both,** as required.

c.) Enter **\\ECHOPAC7-000XXX\Archive** in the **Placement of Image Files** field.

d.) Enter **\\ECHOPAC7-000XXX\Archive** in the **Placement of Report Files** field.

OR

If *Image Vault Server* is required, make sure that the **Image Vault Server** checkbox is *selected*, as shown in Figure 3-48 below, then proceed as follows:

a.) Enter **ECHOPAC7-OOOXXX-DB** in the **Database Name** field.

b.) Under *Store Info,* make sure that the **Hard Drive** checkbox is selected.

c.) Enter **\\ECHOPAC7-000XXX\Archive** in the **Placement of Image Files** field.

d.) *Select* the **Allow Multiframe** and/or **Allow Raw Data** checkboxes, as required. (It is recommended to leave both checkboxes activated, as shown in Figure 3-48 below).

e.) Under the *Image Settings* field, select the required settings.

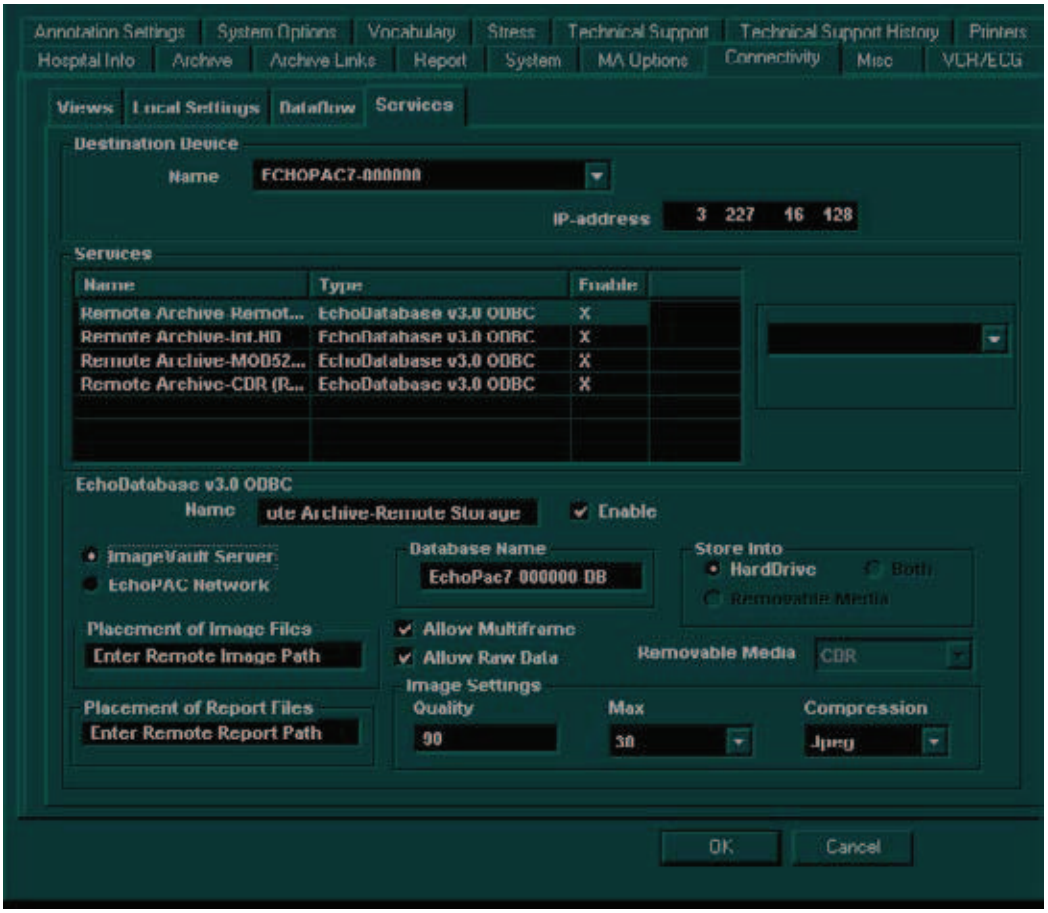

Figure 3-48 Services Tab - Image Vault Server Expanded

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3-7-6-1 Validating Communication with the EchoPAC Server

1) Trackball to the **Views** tab and press **Select**. The **Views** tab is displayed.
2) Trackball to the **Dataflow** button and press **Select**. The full list of data flows is displayed, as shown below.

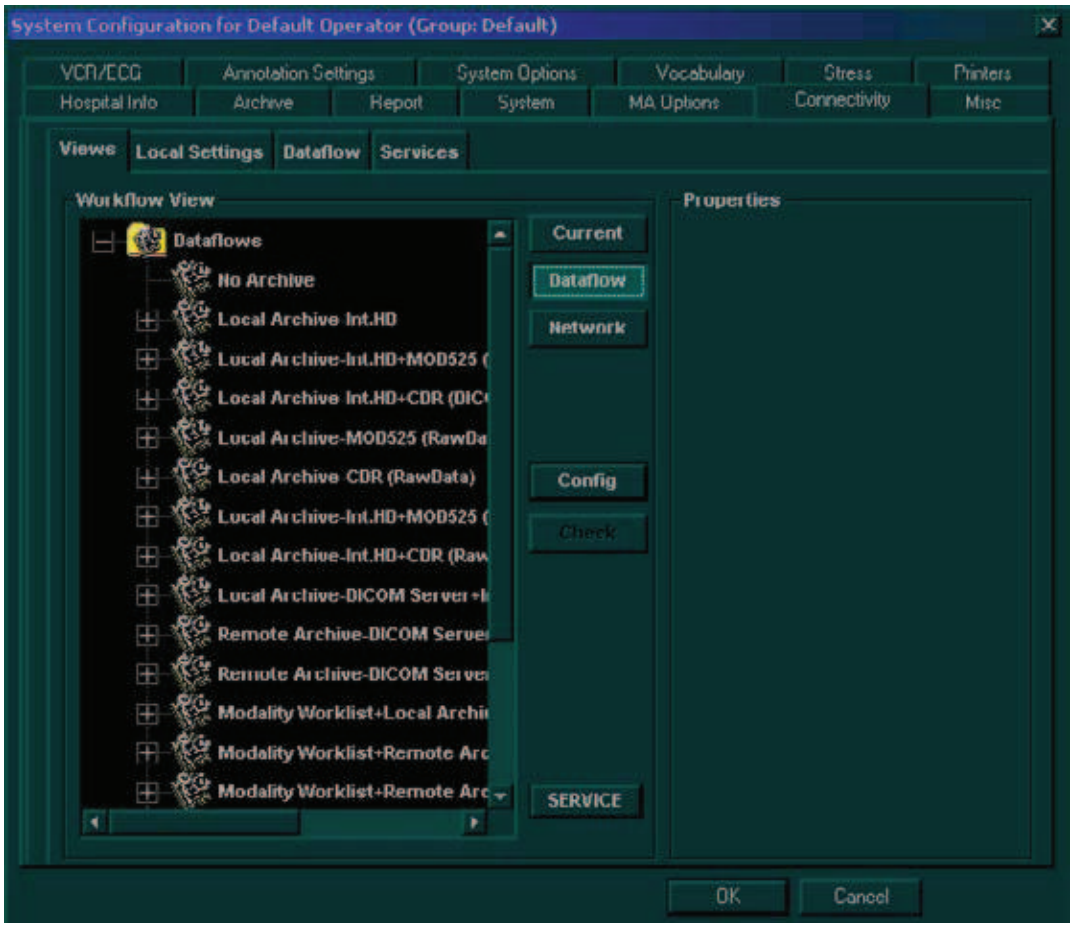

Figure 3-49 Views Tab

3) Expand the **Remote Archive - Remote Storage** branch. A service called **Remote Servers** is displayed.
4) Expand the **Remote Servers** branch. A service called **Remote Archive-Remote Storage** is displayed.
5) Trackball to **Remote Servers** and press **Select**, then trackball to the **Check** button and press **Select**.
   - If the connection is established, a *green checkmark* is displayed.
   - If the connection cannot be established, a *red cross* is displayed.
6) If the connection was successfully established, trackball to the **Remote Archive-Remote Storage** line and press **Select**, then trackball to the **Check** button and press **Select**.
   - If the connection is established, a *green checkmark* is displayed.
   - If the connection cannot be established, a *red cross* is displayed.
7) If both connections were established, click **OK** to exit the configuration procedure. If not, review the entire procedure to locate the error.

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NOTE: ***IMPORTANT INFORMATION ABOUT DATAFLOWS***:
The system's default dataflow is ***Local Archive - Int. HD****. In this configuration, the Patient List is in the local archive and the images are stored on the internal hard drive.*
In a dataflow configuration such as ***Int. HD - MOD 525 (DICOM)****, images are stored both on the internal hard drive and on media (MOD). The name DICOM is shown in parenthesis, signifying that on the MOD, the images are in DICOM format.*
No Archive *is a dataflow that has no output source, for use in emergencies.*

CAUTION: ***DO NOT change the name of an existing dataflow or attempt to add new services to a dataflow!*** **In the event that any changes or additions are required, contact the On-line Center.**

3-7-6-2 Validating EchoPAC or Image Vault Operation

1) Press the **Archive** button on the control console. The *Patient List* window is displayed, as shown in Figure 3-44 on page 3-62.
2) Select the **Remote Archive-Remote Storage** option from the dropdown list at the bottom of the window. If the system will not accept the dataflow, or displays an error message, there is an error in dataflow communication.
3) Begin an exam for a new patient and store some images. The storage process will take longer as each loop is now stored in both raw data and DICOM format.
4) Begin an exam for a new patient. Once the second patient is active, the first patient's exam is closed and sent to the spooler to be sent over the network.
5) Press **<Ctrl+S>** to view the status of the spooler, as described on page 3-63.

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Section 3-8
Storing and Transporting the Unit

The Vivid™ 3 ultrasound unit weighs up to 160 kg (353 lbs), depending on the configuration. To avoid equipment damage and ensure maximum safety while transporting or moving the unit, the following precautions are recommended:

- Before moving, prepare the unit, as described in the *Preparing the Unit for Transport* section, below.
- While moving the unit, follow all safety precautions, as described in the *Safety Precautions for Moving the Vivid™ 3 Unit* section, below.
- When transporting the unit by vehicle, or shipping by air or any other means:
  - Pack the unit in the original packing, as described in the *Packing the Unit into the Wooden Shipping Crate* section, on page 3-71, or the *Packing the Unit in the Cardboard Shipping Carton* section, on page 3-74.
  - Follow all safety precautions.
  - Handle with care.
- When reinstalling the unit, allow sufficient system acclimation time, as described in the *System Acclimation Time* section, on page 3-2.

3-8-1 Disconnecting the Unit when Storing

CAUTION: Never disconnect the power (switch OFF the system circuit breaker or unplug the power plug) before the system is completely shut down. Power disconnection before full system shutdown may cause system boot-up failure. This may require system recovery, by booting-up the system using the software CD.

Before storing the unit or moving it to another site, disconnect the unit as follows:

1) Press the **On/Off** button on the control panel for 5 seconds. A menu is displayed.
2) Select **Full Shutdown** from the displayed menu.
3) Turn the circuit breaker to OFF.
4) Unplug the power cord from the mains power outlet.
5) Loop the cord around the hook on the unit's rear panel.

3-8-2 Preparing the Unit for Transport

Perform the following steps as applicable:

1) Turn the system OFF, including the circuit breaker at the rear of the unit, and remove the plug from the wall.
2) Disconnect all cables linking the unit to any off-board peripheral devices, such as a computer network, printers, etc. Note the marks on each cable, in order to reconnect them later.
3) Secure the unit's power cable.
4) Place all probes in the probe holders. Wrap or place the probe cables on the cable hooks at the front of the unit to ensure that they do not protrude from the unit or interfere with the wheels. Store all other probes in their original cases, soft cloth or foam to prevent damage. The park-port may also be used for a probe connection although it is not active.
5) Ensure that no loose items are left on the unit.
6) Unlock the brakes by pressing down on the pedal to return it to the middle position.

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3-8-3 Safety Precautions for Moving the Vivid™ 3 Unit

CAUTION: Whenever moving the Vivid™ 3 ultrasound unit, always observe the following safety precautions:

1) Proceed cautiously when crossing door or elevator thresholds. Grasp the front handle grips or the back handle bar, and then push or pull. **DO NOT** attempt to move the unit by pulling its cables or probe connectors.
2) Ensure that the unit does not strike walls or door frames.
3) Ensure that the pathway is clear.
4) Move the unit slowly and carefully.
5) Take extra care while moving the unit long distances and on inclines.
6) Avoid ramps with an incline of greater than ten degrees to prevent the unit from tipping over. Once the destination is reached, lock the front wheel brakes.

3-8-4 Wooden Shipping Crate and Packaging Materials

Verify that the following packing materials are available. All these materials are required to safely package the Vivid™ 3 ultrasound unit in the wooden shipping crate for shipment by vehicle, or any other means.

Table 3-20 Packaging Materials for the Wooden Shipping Crate

Item	Description	Qty
1	Crate base	1
2	Antistatic sheet, 2.2x3m	1
3	Top cover/ramp	1
4	Antistatic bag	1
5	Silica gel bag	3
6	Right side wall	1
7	Left side wall	1
8	Front foam	1
9	Back foam	1
10	Keyboard foam	1
11	Back foam, top	1
12	Monitor foam	2
13	Front wall	1
14	Rear wall	1
15	Clips, Clip-lok™	32
16	Steel strip	14
17	Shockwatch label	2
18	Fragile label	2
19	Carton box, flat	2
20	UP label	2
21	Shipping label	2
22	CE label	1
23	Hand level clip remover	1
24	Press-on envelope	2

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3-8-5 Cardboard Shipping Carton and Packaging Materials

Verify that the following packing materials are available. All these materials are required to safely package and transport the Vivid™ 3 ultrasound unit in the cardboard shipping carton for shipment by vehicle, or any other means.

Table 3-21 Packaging Materials for the Cardboard Shipping Crate

Item	Description	Qty
1	Press-on envelope	2
2	Product Label	1
3	Input Pwr. Cable	1
4	Platform (wooden base)	1
5	Ramp	1
6	Antistatic nylon	6.6m
7	Silica gel bag	3
8	Cardboard Package Carton	1
9	Gel Support	2
10	Monitor Support	1
11	Antistatic bag	1
12	Carton cover	1
13	Steel strip	15m
14	Cellotape	20m
15	Staple	22
16	Wood screw	2
17	Fragile label	2
18	Up label	2
19	CE label	1
20	S/N label	1
21	Tax security code label	2
22	Shockwatch label	2
23	Shipping label	2
24	Product locator card	2 (16)
25	Front stopper release label	2

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3-8-6 Packing the Unit into the Wooden Shipping Crate

Note: For details of item numbers in this procedure, refer to the following figures:

- Figure 3-1 on page 3-4
- Figure 3-3 on page 3-6
- Figure 3-4 on page 3-7
- Figure 3-5 on page 3-7.

1) Turn OFF the unit by pressing the ON/OFF button on the control console.
2) Turn OFF the AC circuit breaker on the rear of the unit.
3) Disconnect the mains power plug from the wall outlet.
4) Unplug any probes connected to the unit, and store them in their original cases.
5) Disconnect and remove all external cables from the right and left rear panels and the ECG cable connected to the front panel.
6) Verify the presence of all the external cables listed in Table 3-4 on page 3-13, and pack them in carton A (item 19).
7) Release and unplug the power cable connector from the AC input at the rear of the unit, and loop it on the hook located on the rear cover.
8) Unplug the AC power cable from the monitor.
9) Verify the presence of all the accessories listed in Table 3-5 on page 3-14, and pack them in carton B (item 19).
10) Pack the User Manual and any other manuals in an antistatic bag (item 4).
11) Lay the case base on the floor, with the two wood strips facing upwards.
12) Cover the top side of the base with the antistatic sheet 2.2 m x 3m (7.2 ft x 10 ft) (item 2).
13) Lay the top cover/ramp (item 3) on the floor and push it over the narrow side of the case base, in front of the unit.

Note: The top cover serves first as a ramp on which to roll the unit onto the crate base, and later as the crate top cover.

14) Turn the unit's front wheels inwards and parallel to the unit and lock their swivel movement by pressing the brake pedal down to the right.
15) Push the unit using its front handle and roll it over the ramp on top of the antistatic sheet that was previously placed on the crate base, until the front wheels touch the halting wood strips on each side of the crate base.
16) Move the rear wheels inwards and parallel to the unit and lock all four wheels by pressing the brake pedal down to the left.
17) Remove the top cover (ramp) (item 3) and put aside.
18) Place three Silica gel bags (item 5) in the space under the unit.
19) Pull the unit's control console (monitor) up by pressing the release grip located under the center of the unit's front handle.
20) Cover the two cartons containing the external cables and accessories with antistatic foam, and lay them in the space below the keyboard and the unit's top cover.

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21) Lower the control console (monitor) so that it is pressing down on the two cartons.

NOTICE **Important!**
Verify that the height from the crate base to the top of the monitor does not exceed 132cm (52in)

22) Place the pre-packed manuals in the compartment under the monitor.

23) Insert the two monitor support foams (item 12) under the front of the monitor, one on each side.

24) From above, slip the anti-static cover (item 4) over the unit.

25) Wrap the excess antistatic sheet (item 2) that was previously placed on the platform base around the unit and secure it in place with adhesive tape.

26) Assemble the wooden crate, as described in the following section.

3-8-7 Assembling the Wooden Shipping Crate

The Vivid™ 3 ultrasound unit is packed in a wooden shipping crate comprising various sections. These have rebated joints which are fastened together with 32 Clip-lok™ clips that fit into slots. The sections are as follows:

- Case base
- Left wall
- Right wall
- Front wall
- Rear wall
- Top cover/ramp

To ease the identity of the wooden crate sections, there are red marks on the inner surface of the base, the left wall and rear wall. When the case parts are joined correctly, the three red marks should appear next to each other in one corner. The top cover has also a red mark that should be facing downwards in the corner, where the other three marks meet.

Note: Always insert the short leg of a clip in the appropriate slot first, and then, using the heel of your hand, insert the long leg of the clip into the slot located on the part being joined.

1) Place the *right* wall (item 6) vertically along the right side of the crate base and secure it to the base using three clips (item 15).

2) Place the *left* wall (item 7) vertically along the left side of the case base and secure it to the case base using three clips (item 15).

3) Place the wooden cover (item 3) on top of the right and left side walls and fasten it with three clips (item 15) to each of the side walls.

4) Insert the front support foam (item 8) in front of the front wheels.

5) Place the back support foam (item 9) in front of the rear wheels.

6) Place the keyboard support foam (item 10) in front of the keyboard.

7) Place the monitor support back foam (item 11) at the monitor's back.

8) Put the cases containing the probes (item D) and Peripheral options in their original packing (item E) in the appropriate spaces.

9) Hold the rear wall section (item14) vertically against the rear of the crate and secure it in place using eight clips (item 15).

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10) Hold the front wall (item 13) vertically against the front of the crate and secure it in place using eight clips (item 15).

11) Secure the hand lever (clip remover) tool (item 23) to the outside of the wooden crate, using a screw.

12) Secure the box with two steel strip loops (item 16) around the right and left side walls, and one strip loop around the front and back walls.

13) Place two shock-watch labels (item 17) and all other labels (items 20 to 25) on the outer sides of the wooden box.

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3-8-8 Packing the Unit in the Cardboard Shipping Carton

Note: For details of item numbers in this procedure, refer to the following figures:

- Figure 3-1 on page 3-4
- Figure 3-3 on page 3-6
- Figure 3-4 on page 3-7
- Figure 3-5 on page 3-7.

1) Turn OFF the unit by pressing the ON/OFF button on the control console.
2) Turn OFF the AC circuit breaker on the rear of the unit.
3) Disconnect the mains power plug from the wall outlet.
4) Unplug any probes connected to the unit, and store them in their original cases.
5) Disconnect and remove all external cables from the right and left rear panels and the ECG cable connected to the front panel.
6) Verify the presence of all the external cables listed in Table 3-4 on page 3-13, and pack them in a carton.
7) Release and unplug the power cable connector from the AC input at the rear of the unit, and loop it on the hook located on the rear cover.
8) Unplug the AC power cable from the monitor.
9) Verify the presence of all the accessories listed in Table 3-5 on page 3-14, and pack them in a carton.
10) Pack the User Manual and any other manuals in an antistatic bag.
11) Lay the wooden platform (item 4) on the floor. Leave sufficient free space around the platform.
12) Lay the ramp (item 5) on the floor and attach it to the narrow side of the wooden platform (item 4), that has the front stopper next to it.
13) Cover the wooden platform and the ramp with the antistatic sheet (item 6).
14) Release the front stopper pin by sliding the metal sleeve at the pin's locking base upwards, and then turning it towards yourself.
15) Press the brake pedal to the middle position to unlock the wheels.
16) Turn the front wheels inwards and parallel to the unit, and then press the brake to the right to lock the swivel movement.
17) Using the ultrasound unit's front handle, push the unit over the ramp on top of the antistatic sheet, until the unit is stopped by the rear hook (item D) located at the far end of the wooden platform.
18) Lock the front stopper pin by turning the pin to a vertical position and then sliding the sleeve downwards.
19) Press the brake pedal to the left to lock the unit's wheels.
20) Place three Silica gel bags (item 7) on the platform in the space under the unit.
21) Press the release grip located under the center of the front handle and raise the control console (monitor) by pulling it upwards.
22) Cover the two cartons (item 8) containing the external cables and accessories with antistatic foam and lay them in the space below the control console.

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23) Lower the control console so that it is pressing on the two cartons, and verify that the height from the base of the case to the top of the monitor does not exceed 132cm (52in).

24) Put the manuals into the compartment on the left side if the unit.

25) Slip the antistatic cover bag (item 11) over the unit from above.

26) Wrap the excess antistatic sheet (item 6) that was previously placed in the wooden platform around the unit and secure it in place using adhesive tape.

27) Assemble the cardboard shipping carton, as described in the following section.

3-8-9 Assembling the Cardboard Shipping Carton

The Vivid™ 3 ultrasound unit is packed in a cardboard shipping carton consisting of a cardboard carton cover and a wooden platform, that are joined together with clamps and screws. A ramp for rolling the ultrasound unit on and off the platform is also included.

1) Ensure that the ultrasound unit was properly packed, that the brake pedal is in the parking position and that the front stopper is locked and prevents the unit from moving on the wooden platform.

2) Place the carton cover (item 12) around the wooden platform (item 4), so that the front flap is positioned on the narrow side of the wooden platform.

3) Fasten the carton to the wooden platform along the lower right, rear and left sides with two staples (item 15) on each side.

4) Lift the ramp (item 5) and place it in the front of the carton.

5) Put the accessories carton and probes cartons in their original positions behind the monitor.

6) Fold in the front flaps of the carton cover and fasten them with eight staples (item 15) and two wood screws (item 16).

7) Fold the two short carton flaps in at the top of the carton case, then fold in the long flaps and fasten them with adhesive tape (item 14).

8) Secure the box with two loops of steel strips (item 13) around the right and left side walls, and one loop around the front and rear walls.

9) Place two shock-watch labels (item 17) and all other labels (items 20 through 25) on the outer sides of the carton case.

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Section 3-9
Completing the Installation Paperwork

NOTE: On completion of a Vivid™ 3 ultrasound scanner installation, it is important to record the relevant System Installation details (see Table 3-22 below) and Product Locator Installation details (see Figure 3-50 on page 3-77), for future reference.

3-9-1 System Installation Details

Enter the serial number printed on the main label (refer to the *Main Label* section, on page 1-15), and the other relevant system installation details into the following table:

Table 3-22 System Installation Details

System S/N:	
Location:	
Date:	
Customer Name:	
Service Engineer's Name:	
Comments:	

3-9-2 Product Locator Installation

NOTE: During and after installation, the documentation (i.e. User Manuals, Installation Manuals...) for the peripheral units must be kept as part of the original system documentation. This will ensure that all relevant safety and user information is available during the operation and service of the complete system.

1) Verify that all details have been entered in the System Installation Details form, as described in the *System Installation Details* section, above. If this form has not been completed, enter the details now.

2) Locate the Product Locator Installation Card(s) that are affixed to the monitor and to each of the peripherals, and fill in all details on both the front and back of the card(s) - see Figure 3-50 on page 3-77.

Note: Step 2 may have been completed already by GE personnel.
The Product Locator Installation Card shown in Figure 3-50 may not be identical to the card(s) provided.

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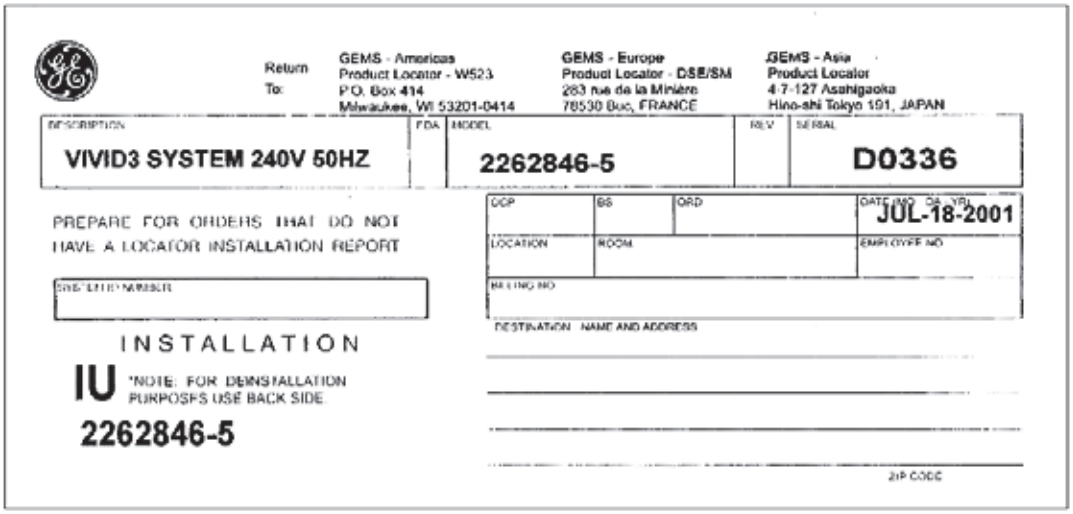

Figure 3-50 Product Locator Installation Card (ICD)

3.) Mail the Product Locator Installation Card(s) to the appropriate product center.

3-9-3 User Manual(s)

Check that the correct *Vivid™ 3 Pro/Vivid™ 3 Expert User Manual(s)* for the system (and relevant software revision), is included with the installation. Specific language versions of the *Vivid™ 3 Pro/Vivid™ 3 Expert User Manual* may also be available. Check with your GE Sales Representative for availability.

During and after installation, supplementary documentation (such as, *User Manuals* and *Installation Manuals* for the peripherals) must be kept as part of the original system documentation. This will ensure that all relevant safety and user information is available during the operation and service of the complete system.

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Chapter 4
Functional Checks

Section 4-1
Overview

4-1-1 Purpose of Chapter 4

This chapter describes the functional checks that must be performed either as a part of the installation procedure, or as required during servicing and periodic maintenance of the Vivid™ 3 ultrasound scanner.

Note: Refer to *Chapter 7 - Diagnostics/Troubleshooting* for detailed descriptions of some of the functional checks described in this chapter.

Table 4-1 Contents in Chapter 4

Section	Description	Page Number
4-1	Overview	4-1
4-2	General Procedures	4-2
4-3	Functional Check	4-3
4-4	Image Testing: 2D/M/CFM/Doppler	4-11
4-5	System Turnover Checklist	4-26
4-6	Site Log	4-33

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Section 4-2
General Procedures

4-2-1 Power ON/OFF and Boot-up Tests

Table 4-2 Power ON/OFF and Boot-up Tests

Step	Task	Expected Result(s)
1	Power up the unit by holding down the **On/Off** button.	Verify that no warning messages are displayed during bootup.
		Verify that all the peripherals are turned ON.
		Verify that all the front-end fans, the back-end fan and the peripherals are working and clean. Listen to fan spinning sound, check filter, go to monitoring and verify that all fans are working.
2	Connect each of the probes available for the system.	Verify that the system properly recognizes each of the probes and displays the correct probe ID.
3	Turn OFF the unit by holding down the **On/Off** button for no longer than 3 seconds.	Verify that system enters Standby mode, indicated by a the blinking **On/Off** button text light.
4	Power up the unit by holding down the **On/Off** button.	Verify that the unit boots up in no longer than 30 seconds.
5	Turn OFF the unit by holding down the **On/Off** button for no longer than five seconds.	Verify that a window is displayed, enabling you to select either *Full Shutdown* or *Standby*.
6	Select the Full Shutdown option.	Verify that the unit enters full shutdown mode, indicated by the **On/Off** button text being dimmed.
7	Power up the unit by holding down the **On/Off** button.	Verify that the unit boots up in no longer than three minutes.
8	Turn OFF the unit by holding down the **On/Off** button for longer than five seconds.	Verify that the unit enters full shutdown mode, indicated by the **On/Off** button text being dimmed. This procedure should be used only during emergencies.
9	Power up the unit by holding down the **On/Off** button.	Verify that the unit boots up in no longer than 3 minutes.

4-2-2 Diagnostic Power Supply Test

Refer to the LVPS Voltage Test on page 7 - 62, and the HVPS Voltage Test on page 7 - 63 for the power test supply procedures (under the MUX Diagnostic Tests section).

Note: The mains power supplied to the system, and the internal Vivid™ 3 ultrasound scanner power supplies, are monitored automatically by the scanner - via the MUX board. Any internal power supply voltage failure may indicate that one (or more) of the following is faulty:

- MUX board
- Incoming AC power supply
- One of the internal power supplies

In rare cases, a fault may be present in the Front-end board, or in a probe.

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Section 4-3
Functional Check

4-3-1 Basic Controls

4-3-1-1 Keyboard and Footswitch Tests

Table 4-3 Keyboard and Footswitch Tests

Step	Task	Expected Result(s)
1	Start checking the alphanumeric keyboard backlights.	All alphanumeric backlights are off.
2	Perform a manual keyboard test, as described in the Manual External Keyboard Test on page 7 - 73.	
3	Push all the buttons, except **Select**, **Menu** and the **On/Off** button.	Verify that only the correct button is activated on the Diagnostic panel.
4	Push all the rocker switches.	Verify that only the correct rockers are activated on the Diagnostic panel.
5	Rotate the optical encoders.	Verify that only the correct optical encoder rotates smoothly in both directions.
6	Press the optical encoders that can be pressed, except for **2D Gain** and **Active Gain**.	Verify that only the correct soft keys are activated on the Diagnostic panel.
7	Move the TGC sliders one-by-one.	Verify that only the correct slider is moving on the Diagnostic panel.
8	Perform an automatic lights test, as described in the Automatic Lights Test on page 7 - 74.	Verify that all the key LEDs are illuminated one-by-one.
9	Select the **Select** option.	All the backlights are turned on, one-by-one. Check that the backlights on the extended and alphanumeric keyboards are illuminated.
10	Return to the *Test Manage*r tab and select **Lights (Manual)**. Select the **KB Panel** tab and deselect the **Select** option.	After the **Select** button LED is deselected, the alphanumeric keyboard LEDs are not illuminated.
11	Connect the footswitch to the connector on the front panel of the unit, and press the right, middle and left of the switch.	Verify that the numbers {68}, {69} and {70} accordingly are displayed on the info bar.
12	Select <**Exit**> to leave the *KB Diagnostic* window.	
13	Perform an alphanumeric keyboard diagnostic, as described in the Keyboard Diagnostic Test on page 7 - 76.	Verify that the Caps Lock LED is illuminated when Caps Lock is active. Refer to Table 4-4 below for special keys. The correct keys or key combinations are displayed.

Table 4-4 Alphanumeric Key Combinations

Key Name	Help	Preset	Config	Text	Page Erase	Line Erase	Arrow					Delete Meas.
A/N Key	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12

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4-3-1-2 Speakers Tests

Table 4-5 Speakers Test

Step	Task	Expected Result(s)
1	Run the audio diagnostic, as described in the Audio (Doppler Sound Driver) Diagnostic Test on page 7 - 70.	
2	Change the frequency and speaker activity, from *right* to *left*.	Verify that there is clear sound from both speakers at all frequencies. Note that *right* and *left* are as seen when standing behind the unit.

4-3-1-3 Video Grabbing Test

Table 4-6 Video Grabbing Test

Step	Task	Expected Result(s)
1	Connect the Y/C OUT to the Y/C IN and run the video grabbing calibration, as described in Video Grabbing Calibration on page 6 - 17.	
2	Examine the grabbed image.	Verify that the grabbed image is stable and has similar grey levels to that of the reference image.

4-3-2 Peripherals

4-3-2-1 VCR Test

Table 4-7 VCR Test

Step	Task	Expected Result(s)
1	Connect a Sony 9600 VCR to the system, restart the system and load an SVHS cassette.	Verify that all the following cables are connected: SVHS In/Out, Audio In/Out and RS232.
2	Connect a 3S probe. Reset the VCR counter and press the **VCR Record** button using the indicated soft keys as displayed on screen.	Verify that the recording indicator (red dot) is displayed on-screen and the tape counter is running on-screen.
3	Activate CW Mode and record 2 minutes of heart scanning or a similar effect using a phantom.	Record 2 minutes of CW scanning.
4	Stop recording and press the **Play B.** button, then use the **Rewind** soft key to rewind the cassette to the beginning before pressing the **Play** soft key.	The recorded Image is played back.
5		Verify that in CW Mode both the *left* and *right* audio channels are working, and that the played back audio is similar to the recorded audio in both the *left* and *right* speakers.

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4-3-2-2 Video OUT Test

Table 4-8 Video OUT Test

Step	Task	Expected Result(s)
1	Activate a CineLoop or Freeze a scanned image.	
2	Connect the monitor to the composite VIDEO OUT 1 connector and check the image.	The image is displayed correctly.
3	Connect the monitor to the composite VIDEO OUT 2 connector and check the image.	The image is displayed correctly.
4	Connect the monitor to the composite VIDEO B/W connector and check the image. See B/W Printer Tests, below.	The image is displayed correctly.
5	Connect the monitor to the Color Printer RGB connectors and check the image. See Color Printer Tests, below.	The image is displayed correctly.

4-3-2-3 B/W Printer Tests

Table 4-9 B/W Printer Test

Step	Task	Expected Result(s)
1	Scan a phantom or suitable interface in 2D-Mode.	
2	Press the **Freeze** button.	
3	Press the **Print B** button.	Evaluate the print quality. Adjust the *brightness* and/or *contrast* of the B/W printer, if required.

4-3-2-4 Color Printer Tests

Table 4-10 Color Printer Test

Step	Task	Expected Result(s)
1	Scan a blood vessels in 2D-Mode or a phantom simulating a similar CFM effect, then activate CFM to see color.	
2	Press the **Freeze** button.	
3	Press the **Print A** button.	Evaluate the color print quality. Adjust the *brightness* and/or *contrast* of the Color printer, if required.

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4-3-3 Mechanical Functions

4-3-3-1 Console Movement Test

Table 4-11 Console Movement Test

Step	Task	Expected Result(s)
1	Pull the front handle located under the control console and lift the console to its maximum height.	Ensure that you do not apply too much force to move the console and that the console movement is smooth.
2	Pull the front handle located under the control console and push the console to its minimum height.	Ensure that you do not apply too much force to move the console and that the console movement is smooth.

4-3-3-2 Brakes Function Test

Table 4-12 Brakes Function Test

Step	Task	Expected Result(s)
1	Push the brake pedal to its *center* position. Push and pull the unit right, left, backwards and forwards.	Ensure that the wheels move freely in all directions. Check the wheels for wear and tear, and replace if necessary.
2	Push the brake pedal to its *left* position (parking). Push and pull the unit right, left, backwards and forwards.	Ensure that the wheels are locked and there is no movement in any direction.
3	Push the brake pedal to its *right* position (arrows). Push and pull the unit right, left, backwards and forwards.	Ensure that the front wheels are locked for right and left movement *only*, but can move freely backwards and forwards.

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4-3-4 Back End Processor Tests

4-3-4-1 Internal ECG Test

Table 4-13 Internal ECG Test

Step	Task	Expected Result(s)
1	Connect the internal ECG input to an ECG simulator or suitable substitute, using the cable set and electrode pads.	
2	Perform the ECG diagnostic test, as described in the ECG/Phono Diagnostic Test on page 7 - 71.	Verify that a single clear QRS signal is displayed.

4-3-4-2 Phono Test (optional)

Table 4-14 Phono Test

Step	Task	Expected Result(s)
1	Connect the microphone to the microphone input on the ECG Board. Note that the special Medical Microphone is required.	
2	Perform the Phono diagnostic test, as described in the ECG/Phono Diagnostic Test on page 7 - 71 Use your finger to click (tap) the microphone.	Verify that the waveform on the screen corresponds to the microphone clicks.

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4-3-4-3 Magneto Optical Drive (MOD) Test

Table 4-15 MOD Test

Step	Task	Expected Result(s)
1	Restart the system performing a full shutdown and bootup, as described in the Power ON/OFF and Boot-up Tests on page 4 - 2.	During the boot-up process, verify that the messages **SCSI Adaptor Installation 2271149-2INS** and **MO** are displayed.
2	Insert a new MO Media Sony EDM-2300B (2.3G) into the MOD.	
3	Press **Ctrl+F11** (or **Alt+D**) on the keyboard and select <Back End>, <Media Driver> and <MO>, as appropriate.	**The UtilMediaApp** dialog box is displayed.
4	Select the **IsMediaAcces** button.	The message **Media in drive G is accessible** is displayed.
5	Select the **EjectMO** button.	The message **Media is outside** is displayed. Check that the media has actually been ejected.
6	Select the **LoadMO** button.	The message **Media is inside** is displayed. Check that the media is actually inside.
7	Select the **Format** button.	The message **Media in drive G was formatted successfully** is displayed.
8	Select the **GetVolInfo** button.	The message **Media in drive G has following properties: Media Label = MY_LABEL, Media File-System Name = FAT** is displayed.
9	Select the **Get BTPsector** button.	The message **The Bytes Per Sector value of media in drive G is 512** is displayed.
10	Select the **SetVolLabel1** button.	The message **Media Label set to TEST_LABEL1** is displayed.
11	Select the **GetVolInfo** button.	The message **Media in drive G has following properties: Media Label = TEST_LABEL, Media File-System Name = FAT** is displayed.
12	Select the **Exit** button and close the Diagnostic Application.	
13	Press the **Archive** button on the keyboard.	The *Patient List* window is displayed.
14	Press the **Utilities** button on the soft menu.	The *General Status* window is displayed.
15	Press the **Removable Media Utility** button.	The *Utility* window is displayed, showing the message: **Free space on Media: 1096 MB**.
16	Type the new label (for example, "Side1"), then select the **Format** button. Confirm "YES" to the warning message.	The message **Current Media Name is:SIDE1. Media was formatted successfully** is displayed. MO Label: SIDE1, MO STATUS: MOUNTED
17	Select the **Eject** button.	The message **Media Ejected** is displayed. MO STATUS: Ejected.
18	Select the **OK** button to exit the utility.	

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4-3-4-4 CD Writer Test

Table 4-16 CD Writer Test

Step	Task	Expected Result(s)
1	Insert the new recordable CD X16 in the CDR drive.	
2	Press **Ctrl+F11** (or **Alt+D**) on the keyboard and select <Back End>, <Media Driver> and <CDR> as appropriate.	**UtilMO_CDR_App** is displayed.
3	Select the **IsMediaAcces** button and <**OK**>.	The message **Media in drive H is accessible** is displayed.
4	Select the **Eject** button. Respond <**No**> to the *Finalize Media? Yes/No* message.	The message **Media is outside** is displayed. Check that media has actually been ejected and select <**OK**>.
5	Press the **Load** button and respond <**OK**> to the message.	The message **Media is inside** is displayed. Check that media is really inside.
6	Press the **Format** button and respond <**OK**> to the message.	The message **Media in drive H was formatted successfully** is displayed.
7	Press the **GetVolInfo** button and respond <**OK**> to the message.	The message **Media in drive H has following properties: Media Label =** **Media File-System Name = CDUDF** is displayed.
8	Press the **Get BTPsector** button and respond <**OK**> to the message.	The message **The Bytes Per Sector value of Media in Drive H is 2048** is displayed.
9	Press the **SetVolLabel2** button and respond <**OK**> to the message.	The message **Media Label set to TEST_LABEL2** is displayed.
10	Press the **GetVolInfo** button and respond <**OK**> to the message.	The message **Media in drive H has following properties: Media Label = TEST_LABEL2** **Media File-System Name = CDUDF** is displayed.
11	Press the **FlushVol** button and respond <**OK**> to the message.	The message **The cached data is flushed to the volume in drive H** is displayed.
12	Press the **Exit** button and close the Diagnostic Application.	
13	Press the **Archive** button on the keyboard.	The *Patient List* window is displayed.
14	Press the **Utilities** button on the soft menu.	The *General Status* window is displayed.
15	Press the **Removable Media Utility** button and select MEDIA: CDRW.	The *Utility* window is displayed showing the message **Free space on Media: 665MB".** **MEDIA LABEL: TEST_LABEL2.** **Media status: MOUNTED**.
16	Press the **Eject** button and respond <No> to the **Do you want to Close Media for external use** message.	MEDIA STATUS: Ejected.
17	Press the **OK** button to exit the utility.	

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4-3-4-5 Plug and Scan Test

Table 4-17 Plug and Scan Test

	Task	Expected Result(s)
1	Press the **On/Off** button on the control console for no more than 3 seconds.	The system enters *Standby* mode.
2	Turn OFF the system's circuit breaker.	The system remains in *Standby* mode, indicated by the blinking **On/Off** button LED.
3	Turn ON the system's circuit breaker. Press the **On/Off** Button.	The system returns quickly to the *Power-ON* state -less than 30 seconds.
4	Turn OFF the system's circuit breaker. Turn ON the system's circuit breaker after entering to Standby mode.	The system enters *Standby* mode and stays in this mode. The **On/Off** button LED is blinking.
5	Turn OFF the system's circuit breaker. Press the **On/Off** button.	The system enters the *Power-OFF* state. The **On/Off** button LED is OFF.

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Section 4-4
Image Testing: 2D/M/CFM/Doppler

NOTE: To perform these tests thoroughly, it is recommended to use three types of soft tissue phantoms: RMI 403GS, RMI 404G and RMI 1425A, or an equivalent surface that can simulate the same soft tissue effects.

4-4-1 3S Probe Image Quality Tests

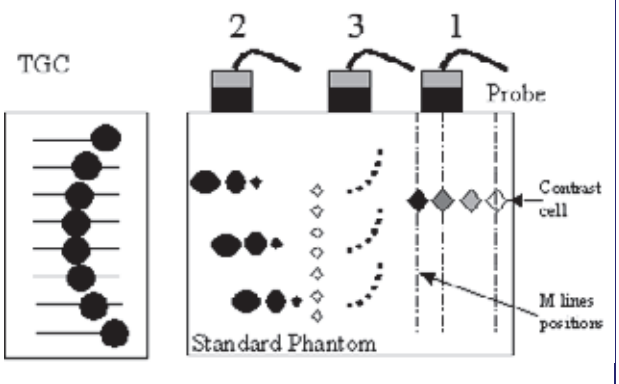
4-4-1-1 2D Noise Uniformity Test

Table 4-18 2D Noise Uniformity Test (3S)

Step	Task	Expected Result(s)
1	With a 3S probe in the air, select a Cardiac preset.	
2	Set the following parameters: • 2D Gain = 50 • Depth = 7cm • Dynamic Range = 80dB	Ensure that there are no white circular lines or other patterns in the noise.

4-4-1-2 2D Performance Test

Table 4-19 2D Performance Test (3S)

Step	Task	Expected Result(s)
1	Use the Standard Imaging Phantom RMI403GS.	
2	Select a Cardiac preset.	
3	Set the TGC so that the image is uniform.	

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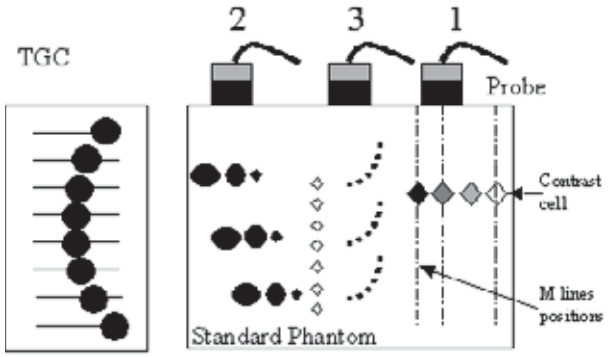
4-4-1-3 2D Penetration Test

Table 4-20 2D Noise Penetration Test (3S)

Step	Task	Expected Result(s)
1	Use the Standard Imaging Phantom RMI403GS.	
2	Select a cardiac preset.	
3	Set the following parameters, and scan the phantom at position (3): • Gain: 37 • Power: 0 dB • Depth: 20cm • Focus: Max depth • Dynamic Range: 65dB	
4	Record the maximum depth at which tissue can be differentiated from the noise.	The depth should be greater than 18cm.

4-4-1-4 CFM Noise Floor Test

Table 4-21 CFM Noise Floor Test (3S)

Step	Task	Expected Result(s)
1	With the 3S probe in the air, select a Cardiac preset and activate CFM.	
2	Set the CFM ROI to its maximum size.	
3	Set the following CFM parameters: • Range: 20cm • Tissue Priority: 0	
4	Set the Active Gain until a few color noise dots appear in the ROI.	The Active Gain should be between 61and 65.

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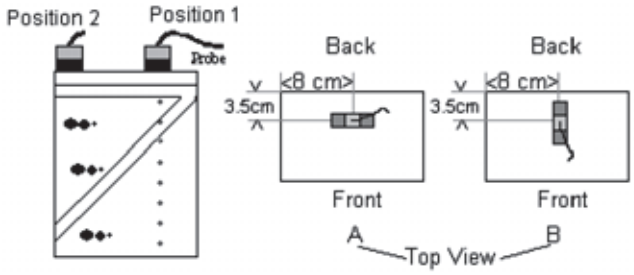
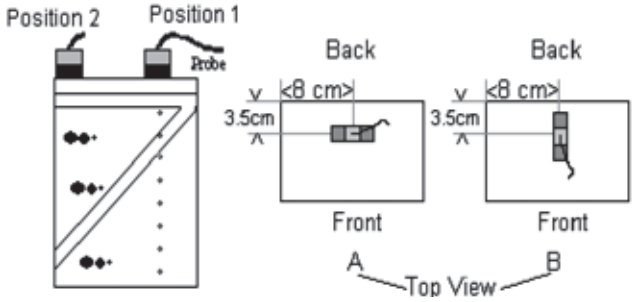
4-4-1-5 CFM Stationary Noise Test

Table 4-22 CFM Stationary Noise Test (3S)

Step	Task	Expected Result(s)
1	Use the vertical nail area in the Electronic Flow Phantom RMI1425A.	
2	Place the 3S probe above the vertical nails line (position 1).	
3	Select a Cardiac preset and activate CFM.	
4	Set the following CFM parameters: • Gain: Max possible without color noise • Tissue Priority: 0 • Flash: 0	Ensure that the color does not appear constantly on the white nail.

4-4-1-6 Probe Operation Check (Alignment and Sensitivity) Test

Table 4-23 Probe Operation Check (Alignment and Sensitivity) Test (3S)

Step	Task	Expected Result(s)
1	Use the Electronic Flow Phantom RMI1425A.	
2	Set the Phantom settings as follows: • Preset: 3 • Mode: Steady	

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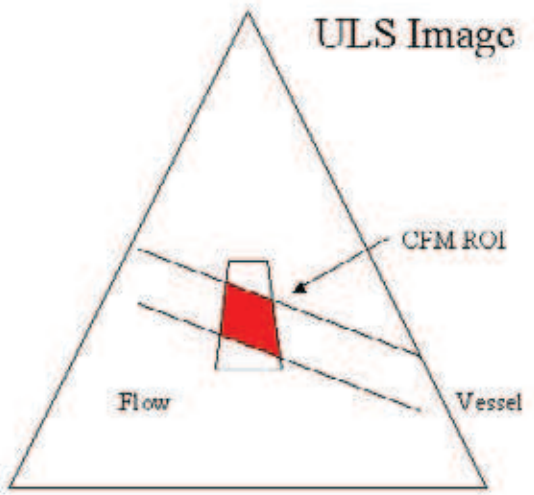
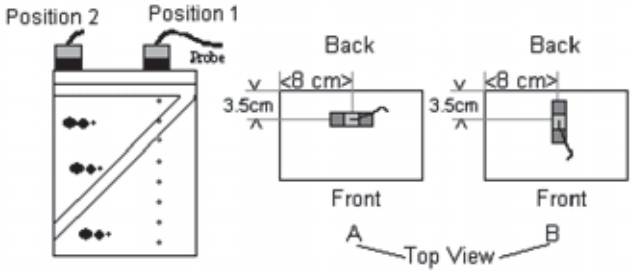
4-4-1-7 CFM Operation Tests

Table 4-24 CFM Operation Tests (3S)

Step	Task	Expected Result(s)
1	Select a Cardiac preset and set the 2D Gain to 40.	
2	Activate CFM and set the following CFM parameters: • Gain: Max possible without color noise • Frame Rate:2 • LVR: MIN setting	
	CFM Artifacts Test	
3	Place the 3S probe on the RMI1425A Phantom (top view A).	Ensure there are no flash strikes or other color artifacts.
	CFM Alignment Test	
4	Rotate the probe 90 degrees (top view B) to see a circular cross-section of the vessel.	Ensure that the color exactly overlaps the vessel.

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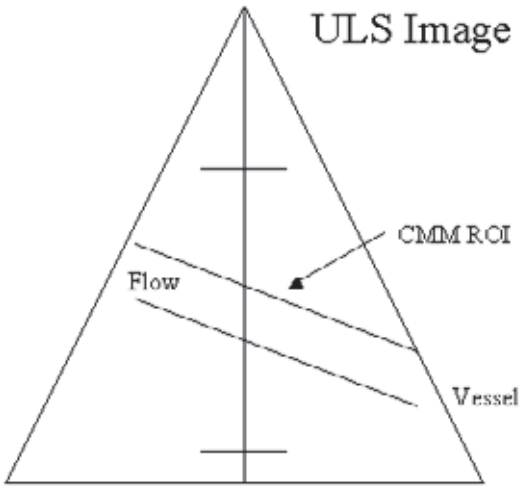
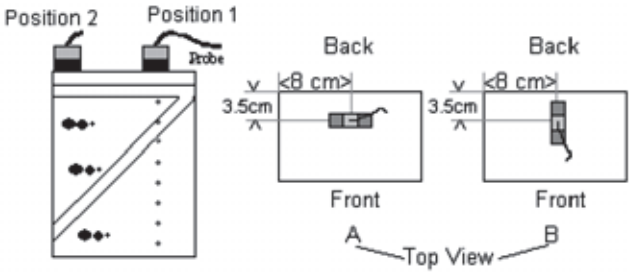
4-4-1-8 Color M Operation Tests

Table 4-25 Color M Operation Tests (3S)

Step	Task	Expected Result(s)
1	Select a Cardiac preset and set the following 2D parameters: • 2D Gain: 50 • 2D Dynamic Range: 60 • 2D Reject: 10%	
2	Activate CFM and set the CFM Gain to the maximum possible without color noise.	
3	Activate M-Mode.	Color M-Mode (CMM) is activated.
4	Place the 3S probe on the RMI1425A Phantom (top view A) and position the M-Marker across the vessel.	 Ensure that you see a continuous orange line. Note that the line does not need to look smooth. Ensure there are no strikes or other artifacts.

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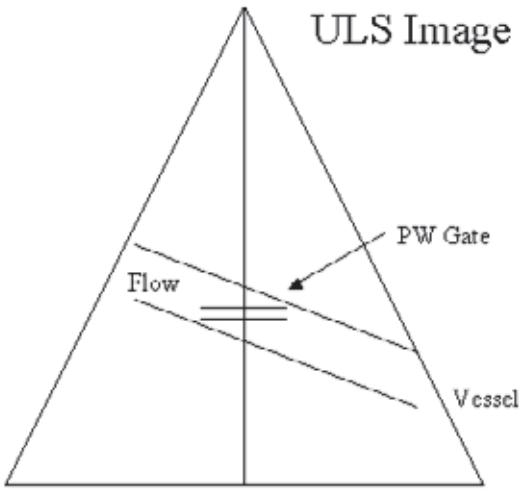
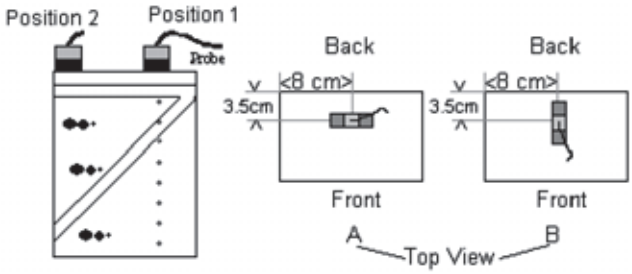
4-4-1-9 PW Operation Test

Table 4-26 PW Operation Tests (3S)

Step	Task	Expected Result(s)
1	Select a Cardiac preset and set the 2D Gain to 40.	
2	Activate PW Mode and set the following PW parameters: • Gain: 70 • SV: 3mm	
	PW Artifacts Test	
3	Place the 3S probe on the RMI1425A Phantom (top view A).	
4	Place the sample volume in the center of the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
5	Move the sample volume to different locations along the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
	PW HPRF Artifacts Test	
6	Increase the velocity range to MAX.	
7	Place the 3S probe on the RMI1425A Phantom (top view A).	
8	Place the sample volume in the center of the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
9	Move the sample volume to different locations along the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.

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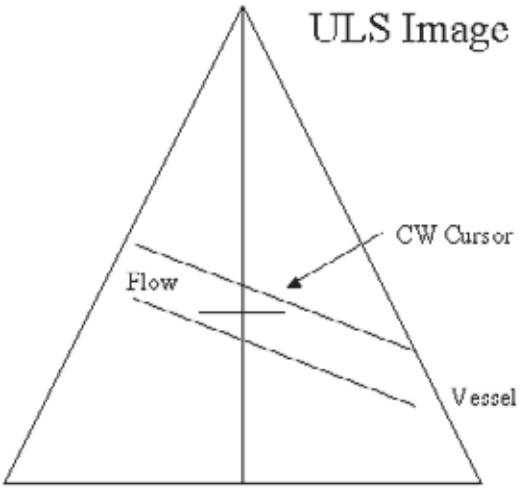
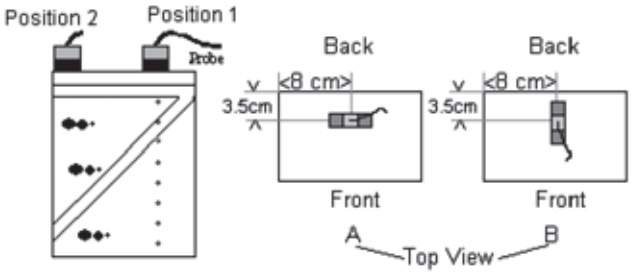
4-4-1-10 CW Operation Tests

Table 4-27 CW Operation Tests (3S)

Step	Task	Expected Result(s)
1	Select a Cardiac preset and set the 2D Gain to 45.	
2	Activate CW Mode and set the following CW parameters: • CW Gain: 70 • Velocity Scale: 3.0m/sec	
	CW Artifacts Test	
3	Place the 3S probe on the RMI1425A Phantom (top view A).	
4	Place the CW cursor in the center of the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
5	Move the CW cursor to different locations along the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
	CW High Velocity Artifacts Test	
6	Increase the Velocity Scale to 8.6m/s (max).	
7	Place the 3S probe on the Phantom (top view A).	
8	Place the CW cursor in the center of the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
9	Move the CW cursor to different locations along the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.

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4-4-1-11 CW Noise Test

Table 4-28 CW Noise Test (3S)

Step	Task	Expected Result(s)
1	With a 3S probe in the air, select a Cardiac preset and activate CW-Mode.	
2	Set the Audio Gain to the minimal level at which the audio noise is just visible.	Check that the Doppler audio and display noise are homogenous and constant.
3	Move the cursor angle multiple times from one half of the screen to the other.	Check that the noise level does not increase after the cursor angle is changed.

4-4-2 7S Probe Image Quality Tests

4-4-2-1 2D Center Noise Test

NOTE: This test should be performed in a dark room.

Table 4-29 2D Noise Center Test (7S)

Step	Task	Expected Result(s)
1	With a 7S probe in the air, select a Pediatrics preset.	
2	Reduce the 2D Gain until the background noise disappears.	
3	Increase the Gain until “flashlight” noise is displayed in the center of the screen, as shown opposite, and write down the Gain value.	
4	Increase the Gain until the background noise is displayed, and write down the Gain value.	Ensure that the Gain difference is not higher than 2.

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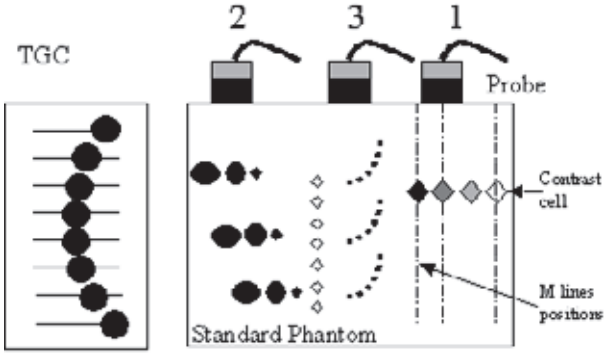
4-4-3 C358 Curved Probe Image Quality Tests

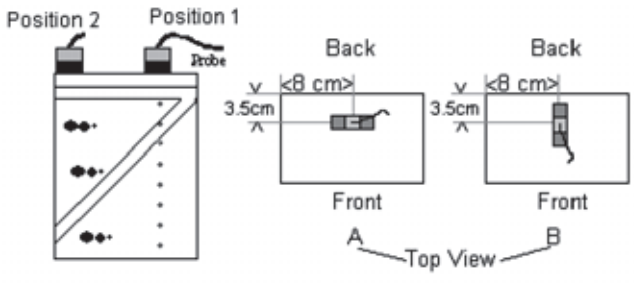
4-4-3-1 2D Artifacts Test

Table 4-30 2D Artifacts Test (C358)

Step	Task	Expected Result(s)
1	Use the Standard Imaging Phantom RMI403GS.	
2	Set the following parameters: • Depth: 22cm • Frame Rate: 2 (single focus) • Focus Location: 12cm	
3		Look for artifacts in the image.

4-4-3-2 CFM Artifacts Test

Table 4-31 CFM Artifacts Test (C358)

Step	Task	Expected Result(s)
1	Use the Electronic Flow Phantom RMI1425A. Select the Abdomen preset from the Abdomen preset options, and set the 2D Gain to 45.	
2	Select CFM and set the following CFM parameters: • Gain: Maximum possible without color noise. • Frame Rate: 2 • LVR: Minimum setting	
3	Place the C358 probe on the Phantom (top view A).	Ensure that there are no flash strikes or other color artifacts.

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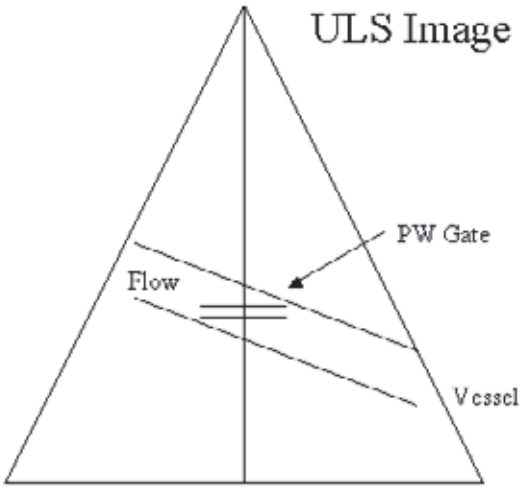
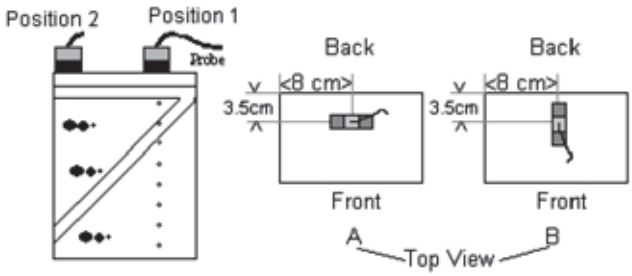
4-4-3-3 PW Operation Tests

Table 4-32 PW Operation Tests (C358)

Step	Task	Expected Result(s)
1	Select the Abdomen preset from the Abdomen preset options, and set the 2D Gain to 45.	
2	Activate PW Mode and set the following PW parameters: • Gain: 70 • SV: 3mm	
	PW Artifacts Test	
3	Place the C358 probe on the RMI1425A Phantom (top view A).	
4	Place the sample volume in the center of the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
5	Move the sample volume to different locations along the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
	PW HPRF Artifacts Test	
6	Increase the velocity range to MAX.	
7	Place the C358 probe on the Phantom (top view A).	
8	Place the sample volume in the center of the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
9	Move the sample volume to different locations along the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.

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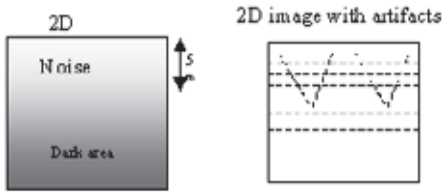
4-4-4 739L Probe Image Quality Tests

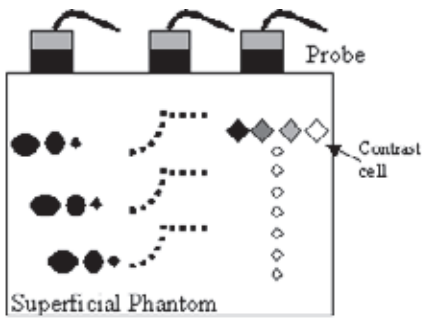
4-4-4-1 2D Noise Uniformity Test

Table 4-33 2D Noise Uniformity Test (739L)

Step	Task	Expected Result(s)
1	With a 739L probe in the air, select the Carotid preset from the Vascular preset options.	
2	Set the following parameters: • 2D Gain = Max • Depth = 2cm • Gain Sliders= Max	
		Up to 5mm of white carpet noise should be displayed, as shown in the left figure above. Ensure that there are no white lines along the image (down to 2cm) or other artifacts like those shown in the figure on the right, above.

4-4-4-2 2D Performance Test

Table 4-34 2D Performance Test (739L)

Step	Task	Expected Result(s)
1	Use the Standard Superficial Phantom RMI404G.	
2	Select the Carotid preset from the Vascular preset options.	
3	Set the following parameters: • Depth: 10cm • Frame Rate: 2 (single focus) • Focus Location: 6cm	

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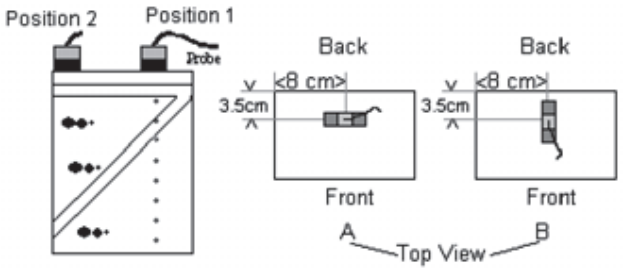
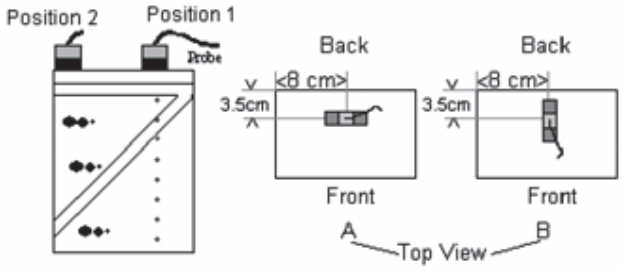
4-4-4-3 CFM Stationary Noise Test

Table 4-35 CFM Stationary Noise Test (739L)

Step	Task	Expected Result(s)
1	Use the vertical nail area in the Electronic Flow Phantom RMI1425A.	
2	Place the 739L probe above the vertical nails line (position 1).	
3	Select a Cardiac preset and activate CFM.	
4	Set the following CFM parameters: • Gain: Max possible without color noise • Tissue Priority: 0 • Flash: 0	Ensure that the color does not appear constantly on the white nail.

4-4-4-4 Probe Operation Check (Alignment & Sensitivity)

Table 4-36 Probe Operation Check (Alignment and Sensitivity) Test (739L)

Step	Task	Expected Result(s)
1	Use the Electronic Flow Phantom RMI1425A.	
2	Set the Phantom settings as follows: • Preset: 3 • Mode: Steady	

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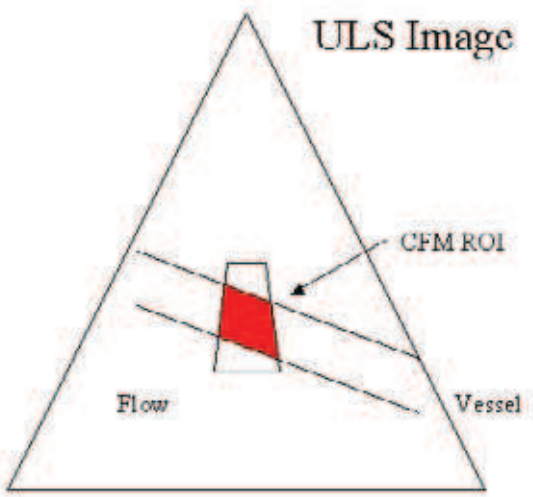
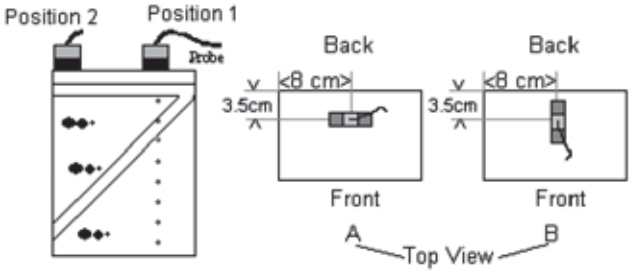
4-4-4-5 CFM Operation Tests

Table 4-37 CFM Operation Tests (739L)

Step	Task	Expected Result(s)
1	Select a Cardiac preset and set the 2D Gain to 40.	
2	Activate CFM and set the following CFM parameters: • Gain: Max possible without color noise • Frame Rate:2 • LVR: MIN setting	
	CFM Artifacts Test	
3	Place the 739L probe on the RMI1425A Phantom (top view A).	Ensure there are no flash strikes or other color artifacts.

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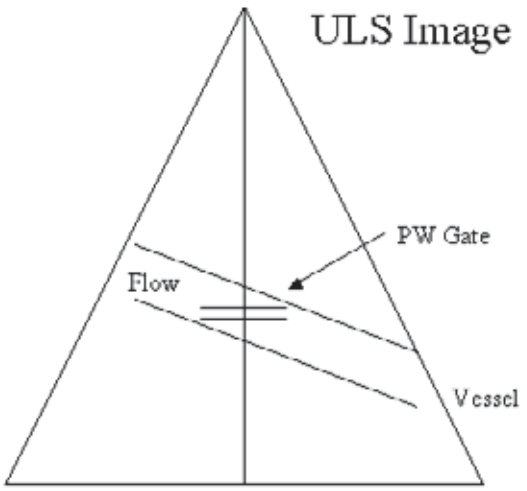
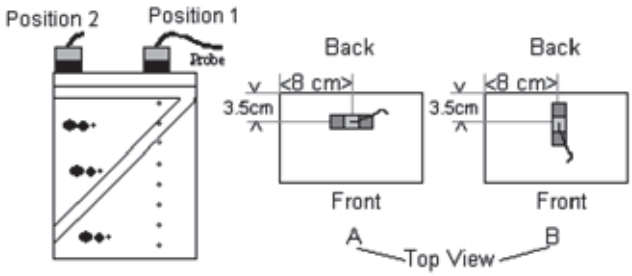
4-4-4-6 PW Operation Tests

Table 4-38 PW Operation Tests (739L)

Step	Task	Expected Result(s)
1	Select the Abdomen preset from the Abdomen preset options, and set the 2D Gain to 90.	
2	Activate PW Mode and set the following PW parameters: • Gain: 70 • SV: 3mm	
	PW Artifacts Test	
3	Place the 739L probe on the RMI1425A Phantom (top view A).	
4	Place the sample volume in the center of the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
5	Move the sample volume to different locations along the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
	PW HPRF Artifacts Test	
6	Increase the velocity range to MAX.	
7	Place the 739L probe on the Phantom (top view A).	
8	Place the sample volume in the center of the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.
9	Move the sample volume to different locations along the vessel.	Ensure that the flow looks clear, the noise area is dark and that there are no flash strikes or other artifacts.

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4-4-5 Probe 10S Image Quality Tests

4-4-5-1 2D Center Noise Test

NOTE: This test should be performed in a dark room.

Table 4-39 2D Noise Center Test (10S)

Step	Task	Expected Result(s)
1	Perform this test with a 10S probe in the air for all the probe ports.	
2	Reduce the 2D Gain until the background noise disappears.	
3	Increase the Gain until “flashlight” noise is displayed in the center of the screen, as shown opposite, and write down the Gain value.	
4	Increase the Gain until background noise is displayed, and write down the Gain value.	Ensure that the Gain difference is not higher than 4.

4-4-5-2 Doppler Artifacts Test

Table 4-40 Doppler Artifacts Test (10S)

Step	Task	Expected Result(s)
1	Perform this test in PW and CW Modes.	
2	Find a suitable surface that can simulate a signal on the neck (for example, RMI1425A) and look for artifacts in all possible frequencies.	No artifacts are detected.

4-4-6 2D (Pencil) Probe Image Quality Test

4-4-6-1 Image Quality Test

Table 4-41 Image Quality Test (2D Pencil Probe)

Step	Task	Expected Result(s)
1	Activate CW Mode.	
2	Find a signal in the neck or other suitable surface.	
	Find a suitable surface that can simulate a signal on the neck (for example, RMI1425A) and look for artifacts while searching for a signal.	No artifacts are detected.

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Section 4-5
System Turnover Checklist

Before returning the Vivid™ 3 ultrasound scanner to regular operational use, the System Configuration settings should be checked. In 2D-Mode, press **Config** on the keyboard and check the settings in accordance with those listed in Table 4-42 below, referring also to Figure 4-1 through Figure 4-6.

NOTE: The figures in this section (Figure 4-1 through Figure 4-6) show example configurations and should be used for reference only, as each site has its own specific settings.

4-5-1 Software Configuration Checks

Table 4-42 Software Configuration Checklist

Step	Task	Check
1	Check the date and time settings.	
2	Check the language settings.	
3	Ensure that all of the options are configured correctly.	
4	Ensure that the hospital details are configured correctly.	
5	Ensure that the VCR and ECG are configured as required for the specific site and country.	
6	Ensure that the measurement units are configured as required for the specific site and country.	
7	Ensure that the connectivity network settings have not been modified and are configured as required for the specific site.	

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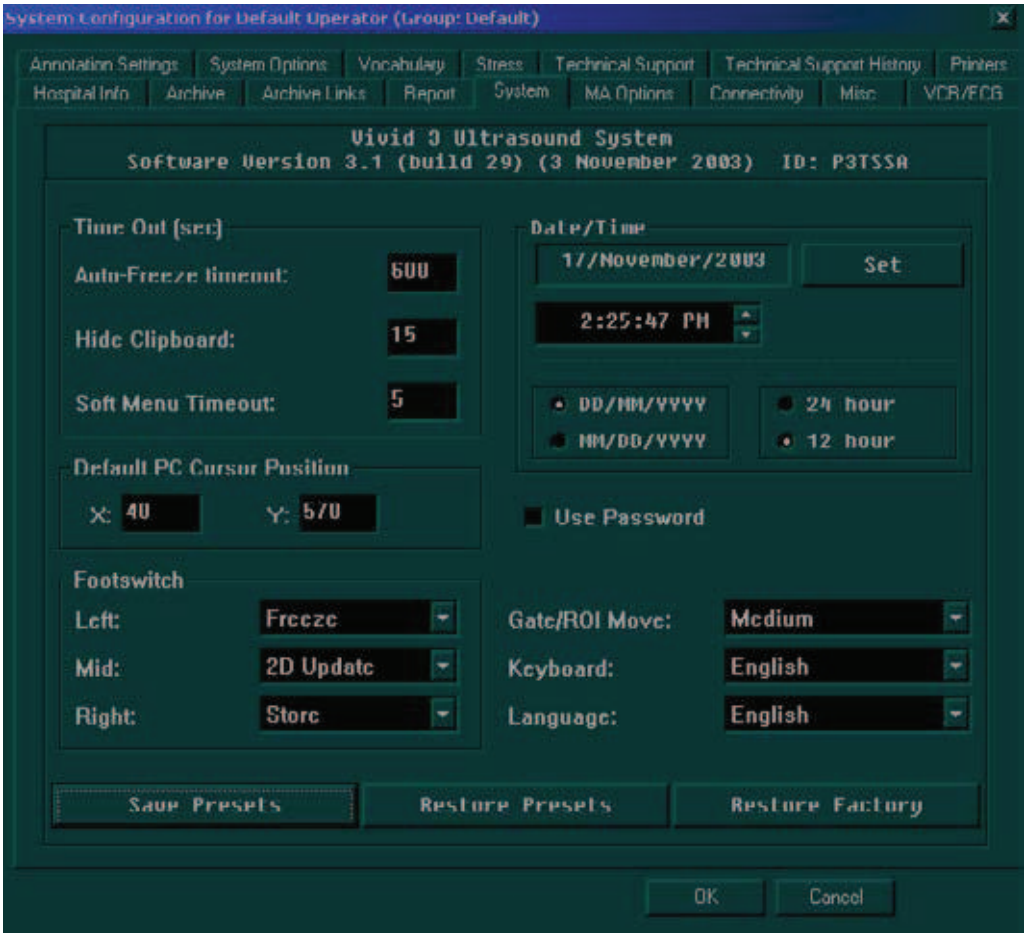

Figure 4-1 System Tab Configuration - Example

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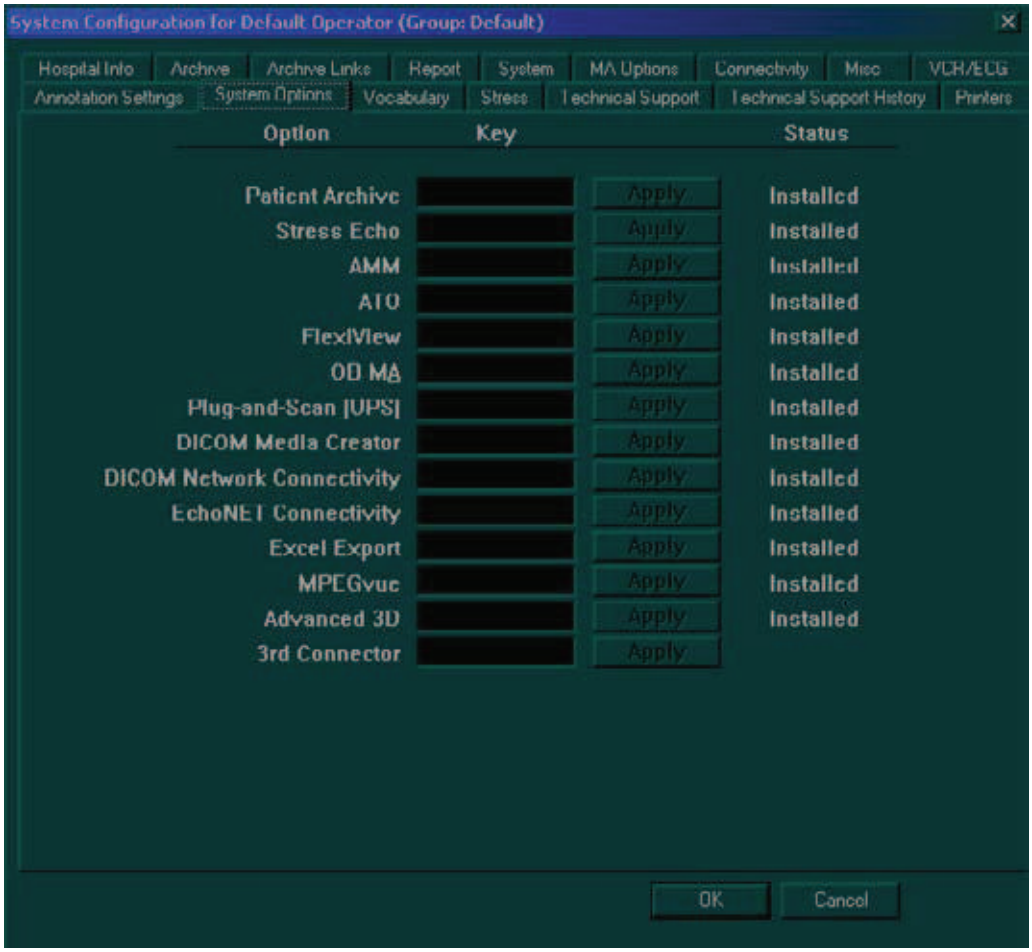

Figure 4-2 System Options Tab Configuration - Example

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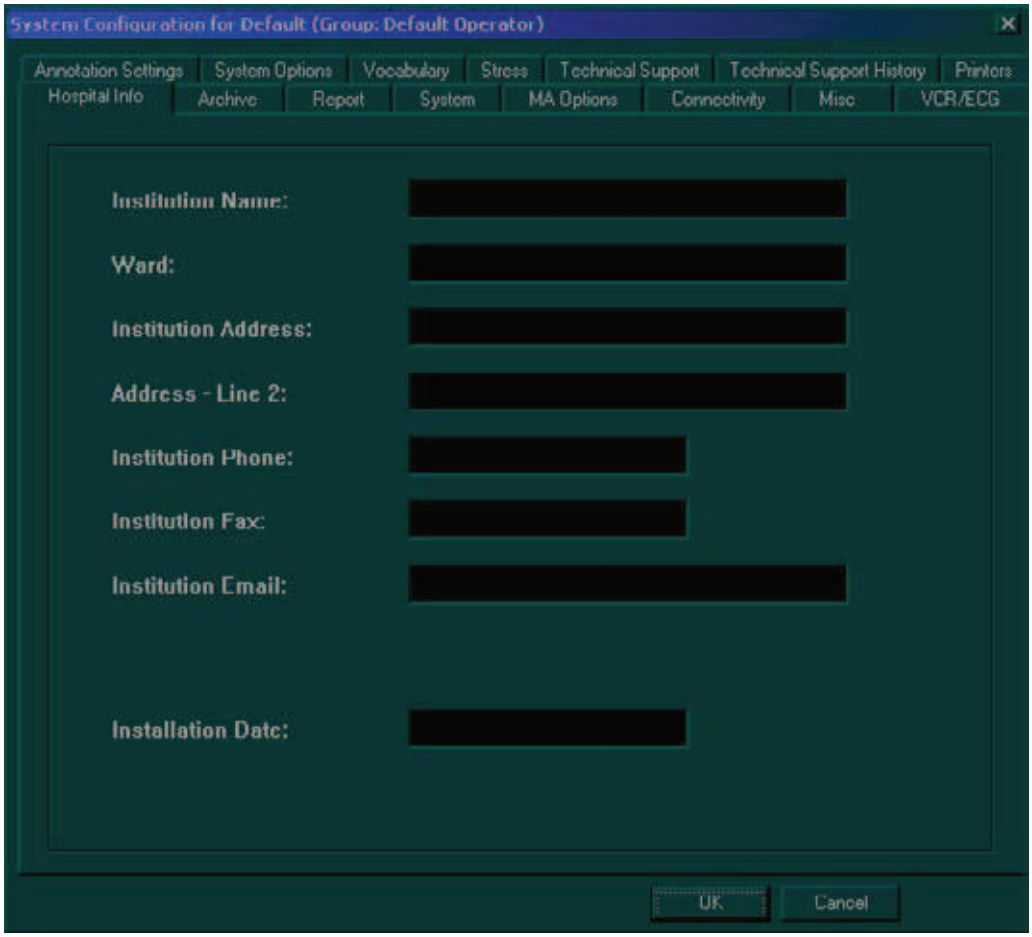

Figure 4-3 Hospital Info Tab Configuration - Example

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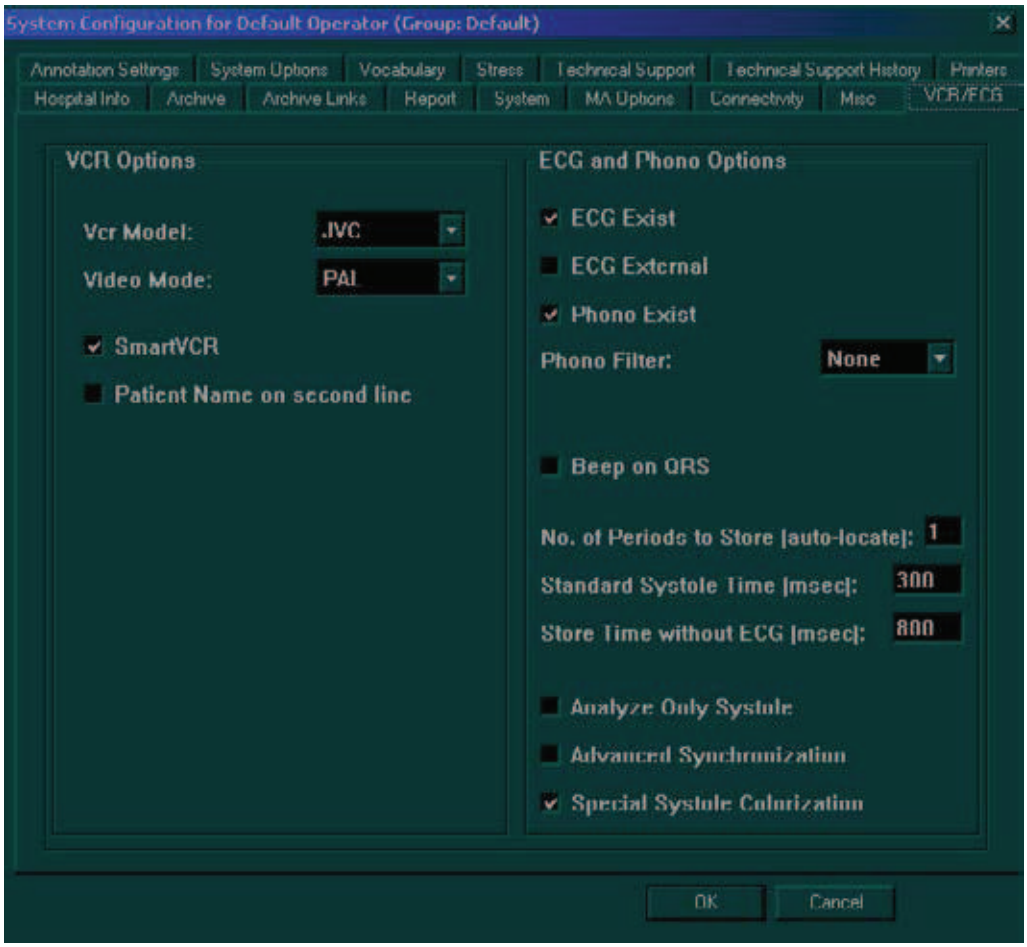

Figure 4-4 VCR/ECG Tab Configuration - Example

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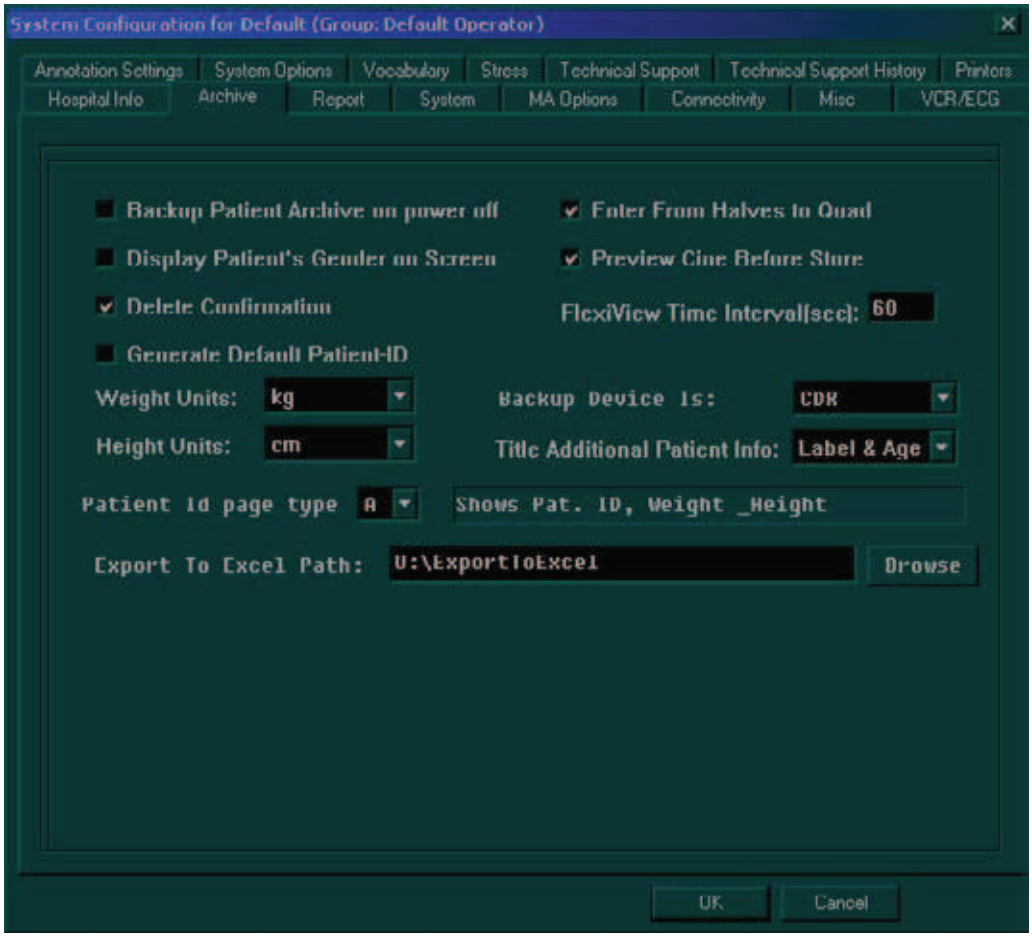

Figure 4-5 Archive Tab Configuration - Example

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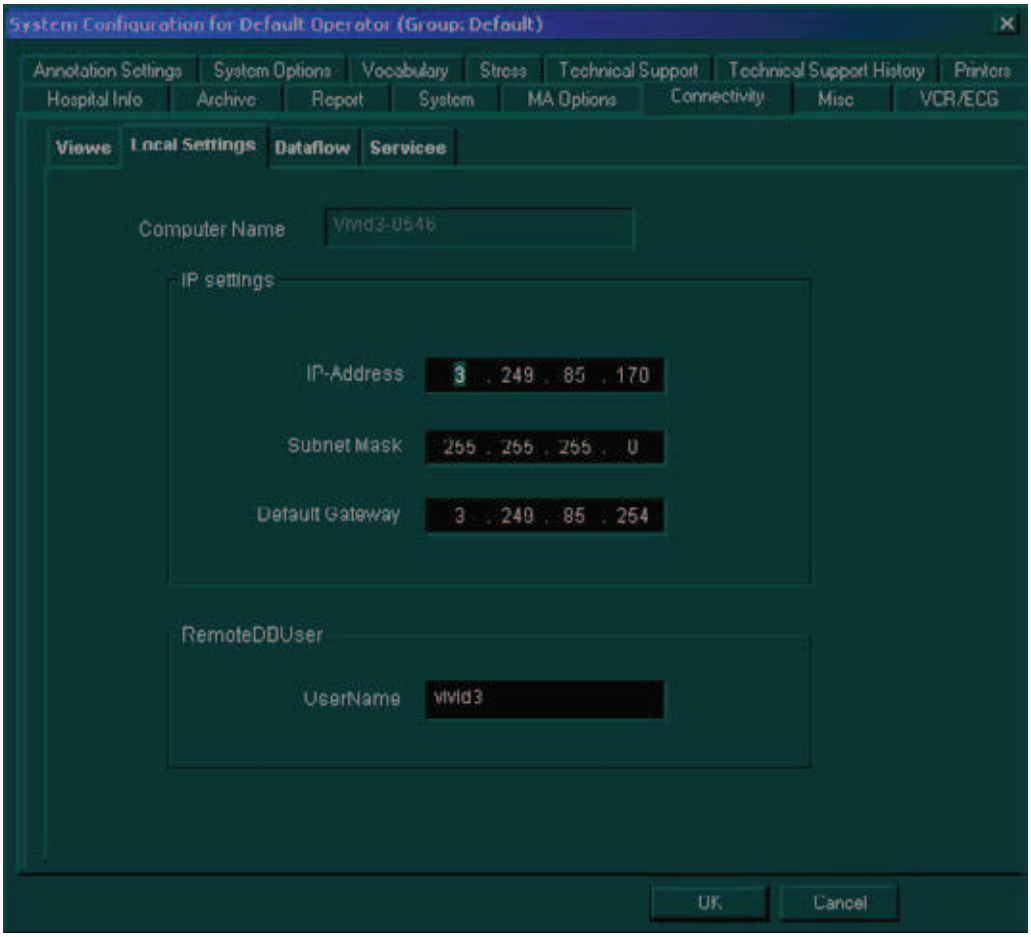

Figure 4-6 Connectivity Local Settings Tab Configuration - Example

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Section 4-6
Site Log

Table 4-1: Vivid™ 3 Site Log

Date	Service Person	Problem	Comments

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Table 4-1: Vivid™ 3 Site Log (Continued)

Date	Service Person	Problem	Comments

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Chapter 5
Components and Function (Theory)

Section 5-1
Overview

5-1-1 Purpose of Chapter 5

This chapter contains block diagrams and functional explanations of the Vivid™ 3 electronic circuits.

Table 5-1 Contents in Chapter 5

Section	Description	Page Number
5-1	Overview	5-1
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5-5	Back End Processor	5-26
5-6	External Peripherals	5-41
5-7	Vivid™ 3 Power Distribution	5-42
5-8	Front End Cooling System	5-49
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Section 5-2
General Information

The Vivid™ 3 is a phased, linear array ultrasound imaging scanner. The system is versatile and, depending upon the software, can be used for various applications, such as:

- 2D Grey Scale and 2D Color Flow Imaging
- M-Mode Grey Scale Imaging
- Color M-Mode
- Doppler
- A number of combinations of the above
- 3D Post-processing

A Physio module is incorporated in the Backend Processor (BEP) to provide ECG signals to synchronize cardiac ultrasound image acquisition. Additionally, other analog inputs (e.g. ECG, phono) from devices such as treadmills, are processed.

Vivid™ 3 is a digital beam forming system which can handle up to 192 element linear probes by use of multiplexing.

Signal flow travels from the Probe Connector Panel, to the Front End (FE) Electronics, to the BEP, and finally is displayed on the monitor and peripherals.

System configuration is stored on a hard disk Hasp plug and all necessary software is loaded from the hard disk on power-up.

- The user initiates system operation via the Control Console which contains a keyboard, control panel, and TGC.
- Vivid™ 3 internal electronics are divided into two card cages:
  - Front End (FE) Processor - sometimes referred to as “Card Cage” in this manual.
  - Backend Processor (BEP)
- Interconnecting signals from the FE, BEP, Control Console, Monitor and Power distribution subsystems are routed via cables.
  The main functional blocks in Vivid™ 3 are:
  - Front End (FE) Processor
  - Back End Processor (BEP)
  - Control Console
  - Power Distribution
  - Peripherals
  - Modem

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Section 5-3
Block Diagrams

5-3-1 System Block Diagrams

The following system block diagrams are included in this section:

- System Block Diagram - Vivid™ 3 BT03 - RFI Configuration (see below).
- System Block Diagram - Vivid™ 3 BT03 - RFT Configuration on page 5 - 4
- System Cabling Diagram - Vivid™ 3 BT03 - RFI Configuration on page 5 - 5.
- System Cabling Diagram - Vivid™ 3 BT03 - RFI Configuration on page 5 - 5.

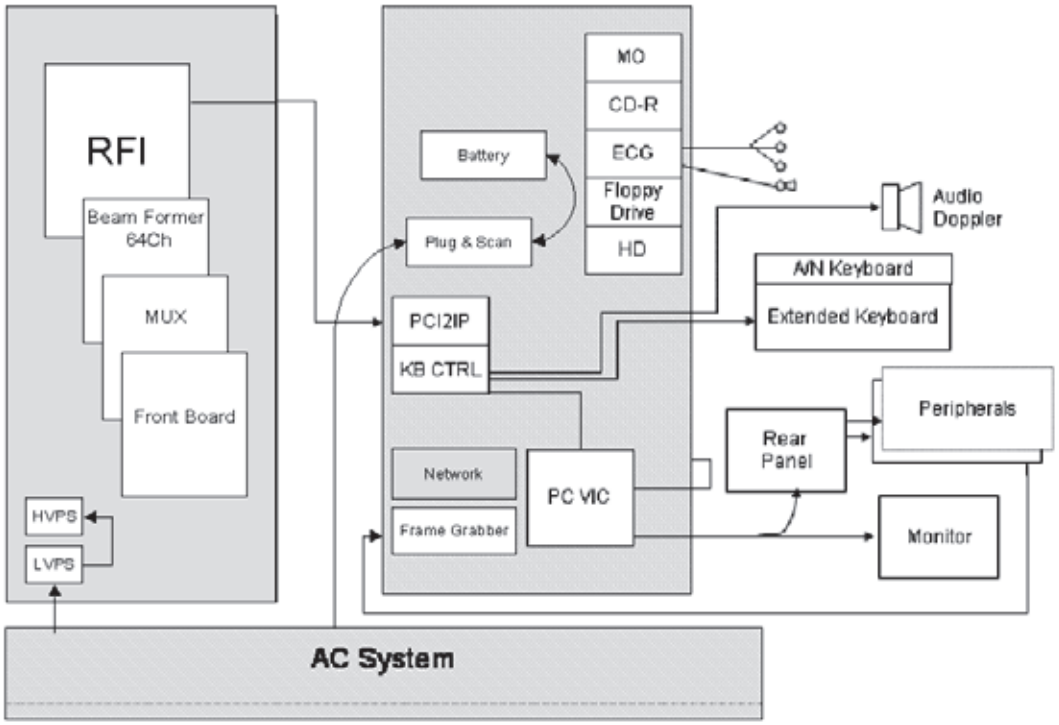

Figure 5-1 System Block Diagram - Vivid™ 3 BT03 - RFI Configuration

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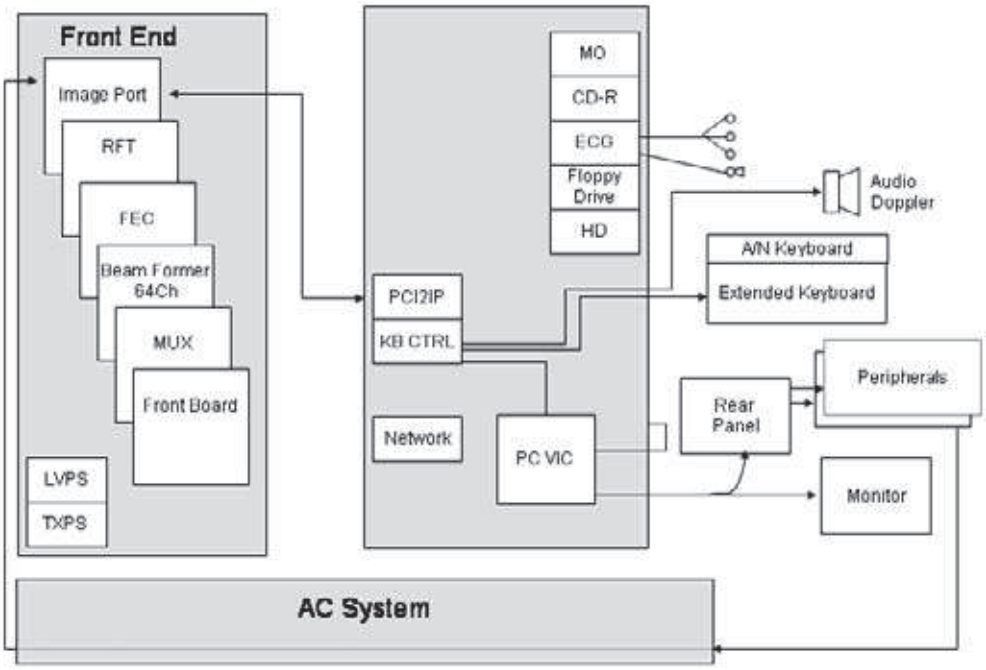

Figure 5-2 System Block Diagram - Vivid™ 3 BT03 - RFT Configuration

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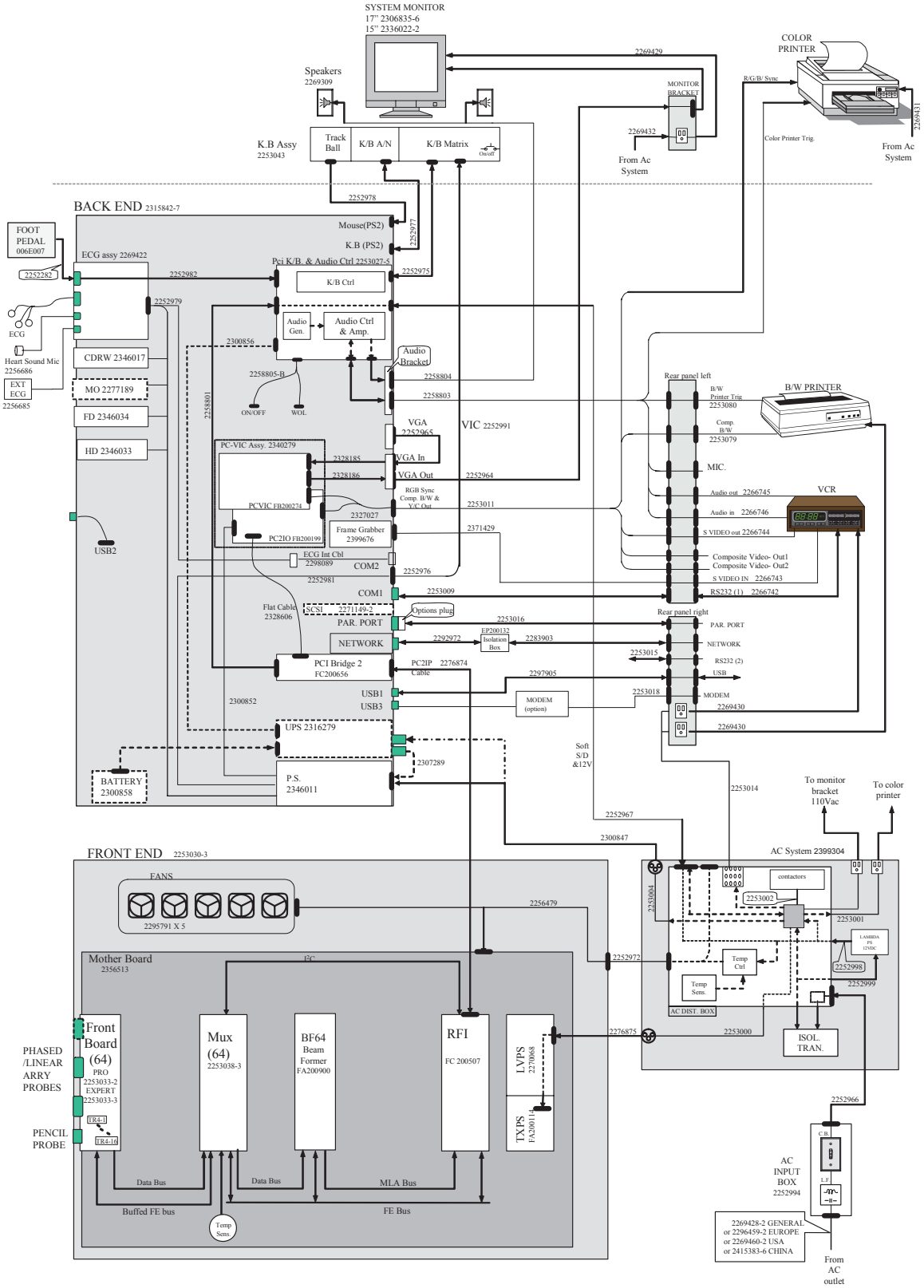

Figure 5-3 System Cabling Diagram - Vivid™ 3 BT03 - RFI Configuration

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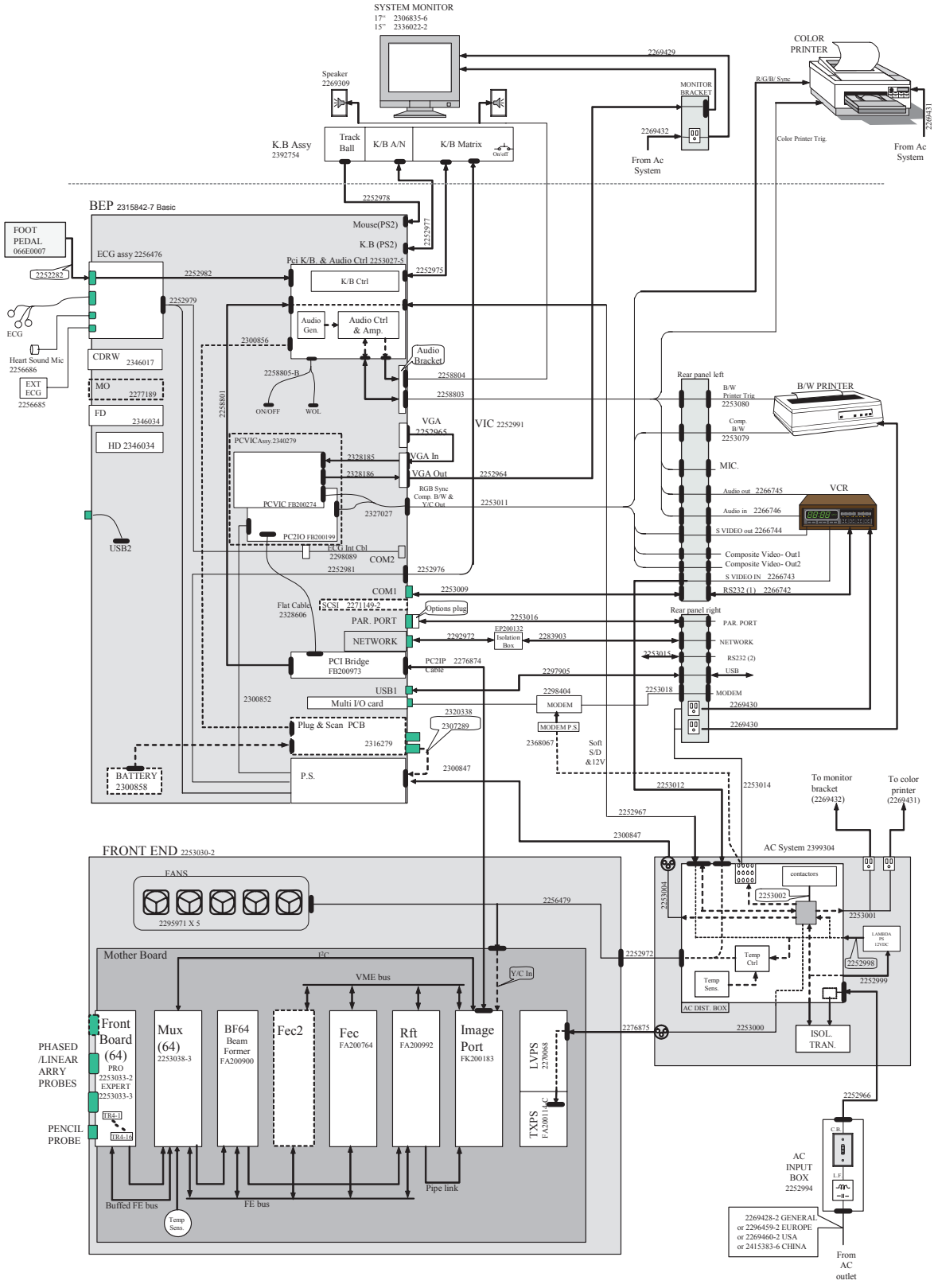

Figure 5-4 System Cabling Diagram - Vivid™ 3 BT03 - RFT Configuration

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Section 5-4
Front End

5-4-1 General Information

The Front End includes all the boards in the Front End Card Cage, as follows:

- Front End Board
- MUX Board
- BF64 (Beamformer Board)
- RFI (Radio Frequency Interface Board)

  OR

  * FEC (Front End Controller Board)
  * RFT (Radio Frequency & Tissue Board)
  * IMP2 (Image Port 2)

The Front End Crate includes five (or seven) components, as described in the following sections:

- Front Board Assembly (FB) on page 5 - 16.
- MUX Board on page 5 - 18.
- Beamformer Board (BF) on page 5 - 19
- Radio Frequency Interface (RFI) Board on page 5 - 20

  OR

  * Front End Controller Board (FEC) (RFT) on page 5 - 23.
  * RF and Tissue Processor Board (RFT) on page 5 - 24.
  * Image Port Board (IMP) on page 5 - 25.
- Back Plane Board (Motherboard) on page 5 - 25.

Note: The VIC Board is located inside the VIC Assembly Unit and is not part of the Front End Crate, but rather a part of the Back End Processor. The VIC Board is described in detail in the *Back End Processor* section, page 5-26.

A block diagram of the Front End Crate is shown in the following figures:

Systems with **RFI** Configuration - see Figure 5-1 on page 5-8.

Systems with **RFT** Configuration - see Figure 5-2 on page 5-9.

For a detailed description of the Front End Crate components, refer to Front End DC Power Distribution on page 5 - 47.

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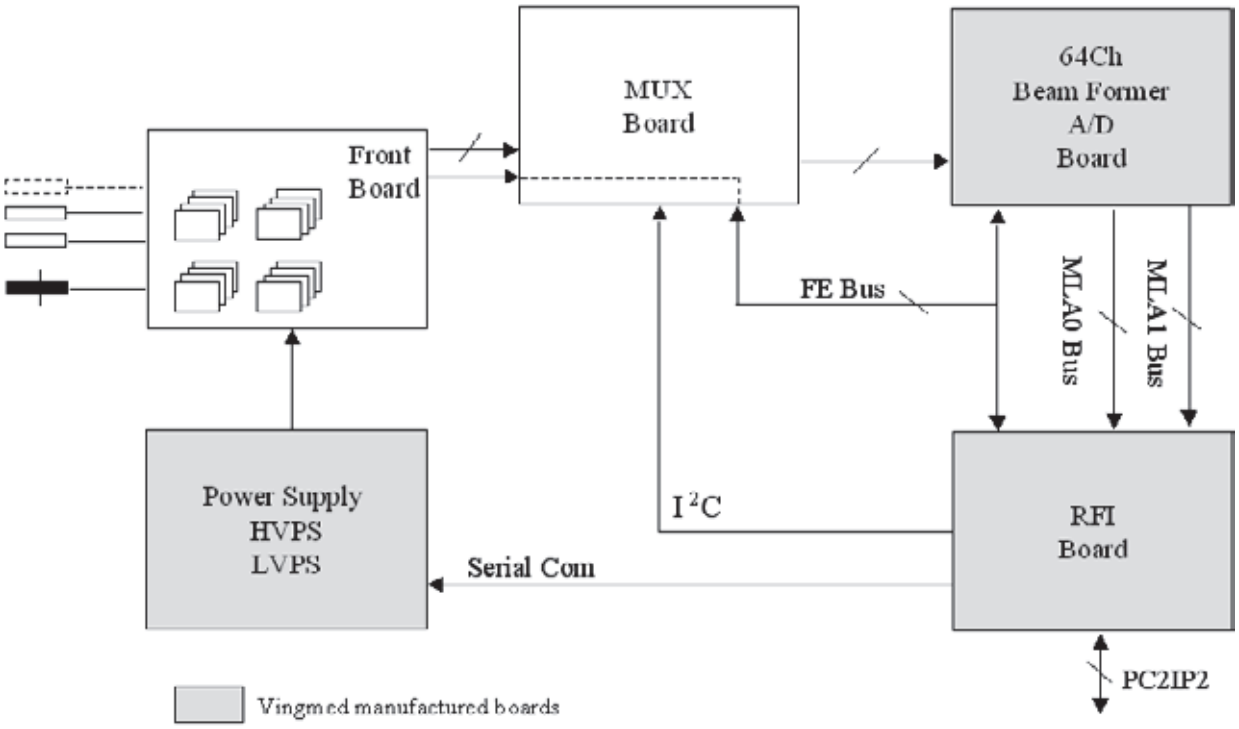

Figure 5-1: Front End Crate Block Diagram - RFI Configuration

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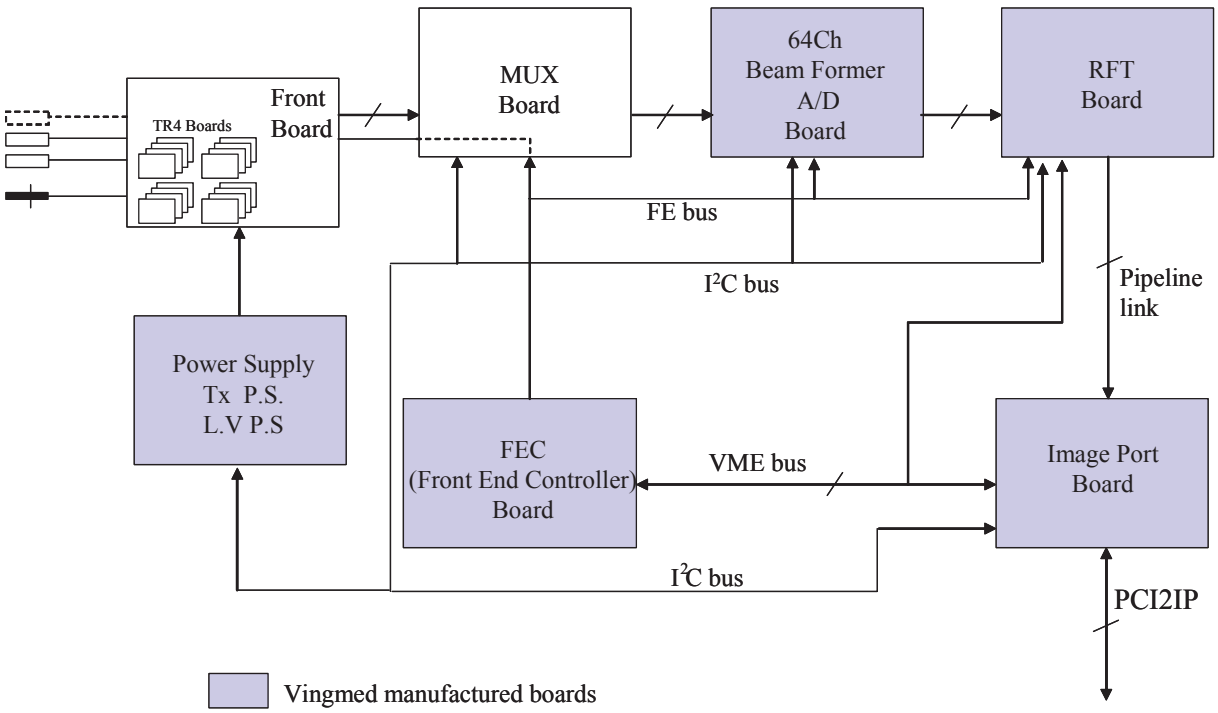

Figure 5-2: Front End Crate Block Diagram - RFT Configuration

The Front End can be divided into two subsystems, as follows:

1.) The **Front End subsystem** which includes:
- Front Board
- MUX Board
- BF64 (Beamformer Board)

2.) The **Mid Processors subsystem** which includes:
- RFI (Radio Frequency Interface Board)

  OR

  * FEC (Front End Controller Board)
  * RFT (Radio Frequency & Tissue Board)
  * IMP (Image Port).

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5-4-1-1 Front End Bus

Most of the FE boards are controlled by the Front End Controller or RFI board via a Front End Bus (FE_BUS). The FE_BUS is a synchronous and bidirectional bus built up by 16-bit data, 6-bit device address select, 10-bit page address and 8 strobe signals controlling the data transactions. The Front End Controller or RFI board can also read the revision status of the Front End boards through a serial line I^2C to an E^2PROM located on each board, and some probes.

5-4-1-2 Phased and Linear Array Front End

- The phased and linear array probes consist of several identical transducer elements (for example, 64, 128, 192). Three probes and a pencil probe can be connected to the system. The connectors are physically located on the FB board, where one of them is selected and connected to the transmitter (TX) and receiver (RX) through a number of relays.
- Depending on probe type and system setup, a certain scan pattern is selected on the FEC (or RFI) board. This board loads scan parameters for both the transmitter and the beamformer (steering- and focusing delays) into local RAM on these boards. Thus, when the FEC (or RFI) board goes through a scan sequence, it loads the proper contents of the RAM into the Transmitter Pulse Generator (TPG), then issues a transmit trigger pulse (TXTRIG_L) for the transmitter and a receive synchronization pulse (SYNC_L) for the beamformer. By firing the transmit pulses from the different elements at certain repeated time intervals and with different delays, the ultrasound beam can be steered in desired directions (re. principles of operation) obtaining the selected scan patterns (for example, 2D, 2D Flow, etc.).
- The ultrasound transmit bursts are generated on the Front board (FB), initiated by the transmit trigger pulse (TXTRIG_L). The transmit trigger starts the Transmit Pulse Generators (TPG) on the FB, each generating 16 transmit pulses with different delays. The transmit pulses are then routed to separate transmit “amplifiers” fed with voltage HV1 and HV2 witch are controlled by the Acoustic Power control software.
- The transmit pulses are routed over TR4 boards located on the Front board (FB), where they are fed to the selected (one out of three) phased/linear array probe.
- The reflected signal from body structures and blood cells are routed from the probe, via the Front board over the TR4 boards, where pre amplification (20dB) and Analog Time Gain Compensation (ATGC) (-10 - +30 dB) is performed. Gain is determined by an analog signal (ATGC) generated by the FEC (or RFI) board.
  At the input to the Front board are transmit/receive (T/R) switches to prevent the transmitters from destroying the receivers. Prior to pre amplification, the signals from the different channels were also fed through relays. This provides the possibility to route echoes from annular array probes into the receiver, in addition to injecting a test signal, TSIG.
- The output channels from the TR4 boards are fed to the MUX board via one Beamformer-64 board. The Beamformer board performs A/D conversion of 64 channels.
- The Front End Controller board controls all Front End boards (on systems with the RFT configuration). The board loads all parameters to the FB, MUX and Beamformer RAMs, it reads the probe identification, selects probe connector on TR4 boards and controls the high voltage multiplexer in linear probes. In addition, the board generates the following:
  * a transmit trigger pulse for TR4.
  * a receive synchronization pulse (SYNC_L) used by Beamformers and RF & Tissue Processor.
  * a differential ATGC voltage used by TR4 and control signals for the High Voltage Power Supply (HVPS).
  * system master clock generator (40 MHz).
  * a reset pulse (SRES).

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- The Radio Frequency Interface (RFI) board controls all Front End boards (on systems with the RFI configuration). The board loads all parameters to the FB, MUX and Beamformer RAMs, it reads the probe identification, selects probe connector on TR4 boards and controls the high voltage multiplexer in linear probes. In addition, the board generates the following:
  * a transmit trigger pulse for TR4.
  * a receive synchronization pulse (SYNC_L) used by Beamformers and RF & Tissue Processor.
  * a differential ATGC voltage used by TR4 and control signals for the High Voltage Power Supply (HVPS).
  * system master clock generator (40 MHz).
  * a reset pulse (SRES).
  * receive focusing control
  * analog test signal generator
  * temperature sensing for TEE probes
  * step motor control for TEE probes
- The output from the Beamadders at BF is fed to the RFI (or RFT) board.

5-4-1-3 Transmitter Power Supply

The transmitters on the TR4 boards (HVPS on FB) are fed with high voltage from the TX supply. This module consists of three linear power supplies; one providing a symmetrical output voltage ranging from 0 to +/- 80 V (HV1), another providing a voltage ranging from 0 to +/- 40 V (HV2), and the third outputting +/- 80 V for the multiplexers in the linear probes. HV1 and HV2 are programmable through a serial interface from the FEC board.

5-4-1-4 Mid Processors

The Vivid™ 3 Front End and visualization system are interconnected through digital signal processing modules, called the Mid Processors. These processors perform the adequate signal conditioning for the different data types; *Tissue*, *Doppler* and *Flow*. The current Mid Processors are the RF & Tissue Processor board (RFT).

5-4-1-4-1 Pipelink Bus

- The Mid Processors are interconnected through a data bus system called the Pipelink. This is a uni-directional bus, transporting data from the pipelink dispatcher (RF & Tissue Processor) through the accessed processor, to the destination - the Image Port. The Image Port will then map the data into the Image Memory.
- Data leaving the RF & Tissue Processor have a tag indicating what type of data is transported; for example, *tissue*, *Doppler*, *2D Flow*. Each of the remaining mid processors decode this tag and when it matches their own address, the data is processed.
- In 2D mode, data is typically transferred in vector blocks from the RFT board. In Doppler and Color Flow, data from one range gate is transferred.

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5-4-1-4-2 MLA-0 and MLA-1 Buses (RFI configuration only)

- The Mid Processors are interconnected through a data bus system called the MLA-0 and MLA-1. These are uni-directional buses, transporting data from the Beamformer to the Demodulator FPGA on the RFI.
- Data leaving the Demodulator FPGA have a tag indicating what type of data is transported; for example, *tissue*, *Doppler*, *2D Flow*. Each of the remaining mid-processor components decode this tag and when it matches their own address, the data is processed.
- In 2D mode, data is typically transferred in vector blocks from the Demodulator FPGA. In Doppler and Color Flow modes, data from one range gate is transferred.

5-4-1-5 Transmit Signal Path

The transmit signal is configured via the operating mode that was selected by the user. When this mode is selected, it sets those operating parameters for the FEC, and the FEC sends a signal to the high voltage power supply (HVPS) to program one of the supplies (HVPS1 or HVPS2).

Once the signal is transmitted, it is received by the transmit pulsor (TP) which is a switching device that will propagate the signal between different elements of the probe. The propagation of that signal depends on the way in which the FEC programs the Front board RAM table.

The signal from the HVPS comes in to the TP; the TP then generates a signal to the probe (connected to the Front board), in accordance with a command generated in Timing Pulse Generator (TPG). The TPG operates according to tables in the RAM table - see Figure 5-6 on page 5-12.

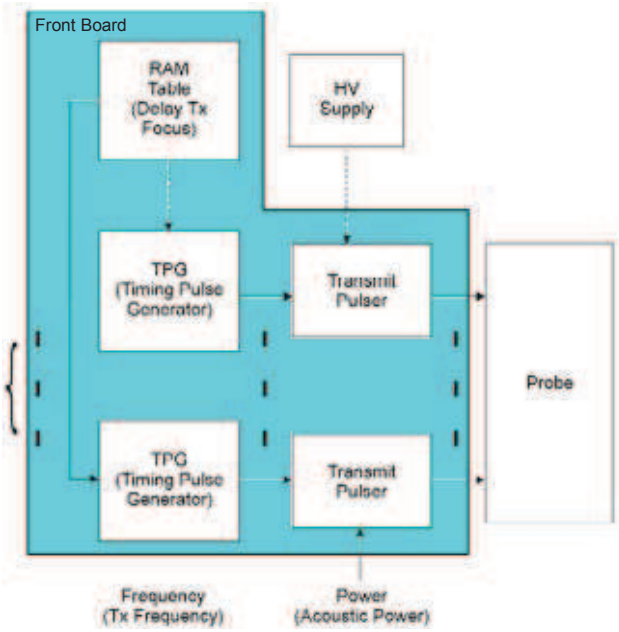

Figure 5-6 Transmit Signal Path Block Diagram

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5-4-1-6 Received Signal Path

The receive signal is programmed according to the operating mode that was selected by the user. In some cases the signal is received immediately after it has been transmitted, sometimes after a prescribed delay, and in other cases at the same time as transmission (transmit/receive simultaneously).
Refer to Figure 5-8 on page 5-15 or Figure 5-8 on page 5-15, as appropriate.

The probe elements receive the echo signals from different depths. These signals are amplified and conditioned at the Analog Time Gain Compensation (ATGC) control. The different operating modes dictate in which way the signals are translated, as follows:

- *Continuous Mode (CW)* - echo signals are transmitted and received simultaneously, and translated per echo point for a specified depth. This provides a real-time image.
- *2D Mode* - signals are received from all 64 channels (if a probe has more than 64 elements, the MUX of the probe is used to create the additional missing channels). The signals are transmitted at a prescribed delay between the elements, and immediately after this are received (all the time, aiming at one point at a specific depth). In this way, echo signals are collected from all points along a certain line, from which a vector is created. The vector is transmitted to the MUX board, and from there to the Beamformer where it is amplified and undergoes analog-to-digital conversion. From here RF signals are transmitted to the RFT board, where an image is created.
- *Color Flow Mode (CFM)* - shows the movement of particles (this mode is usually used together with 2D mode). In CFM mode, the echo signal received is used to measure the amount of frequency phase change (degree of shift) - this is referred to as the *Doppler effec*t. When using CFM and 2D modes together, at the same time that the signal is received, in parallel it is used to generate a signal through a circuit that translates the Doppler effect, and from which it generates a color image.

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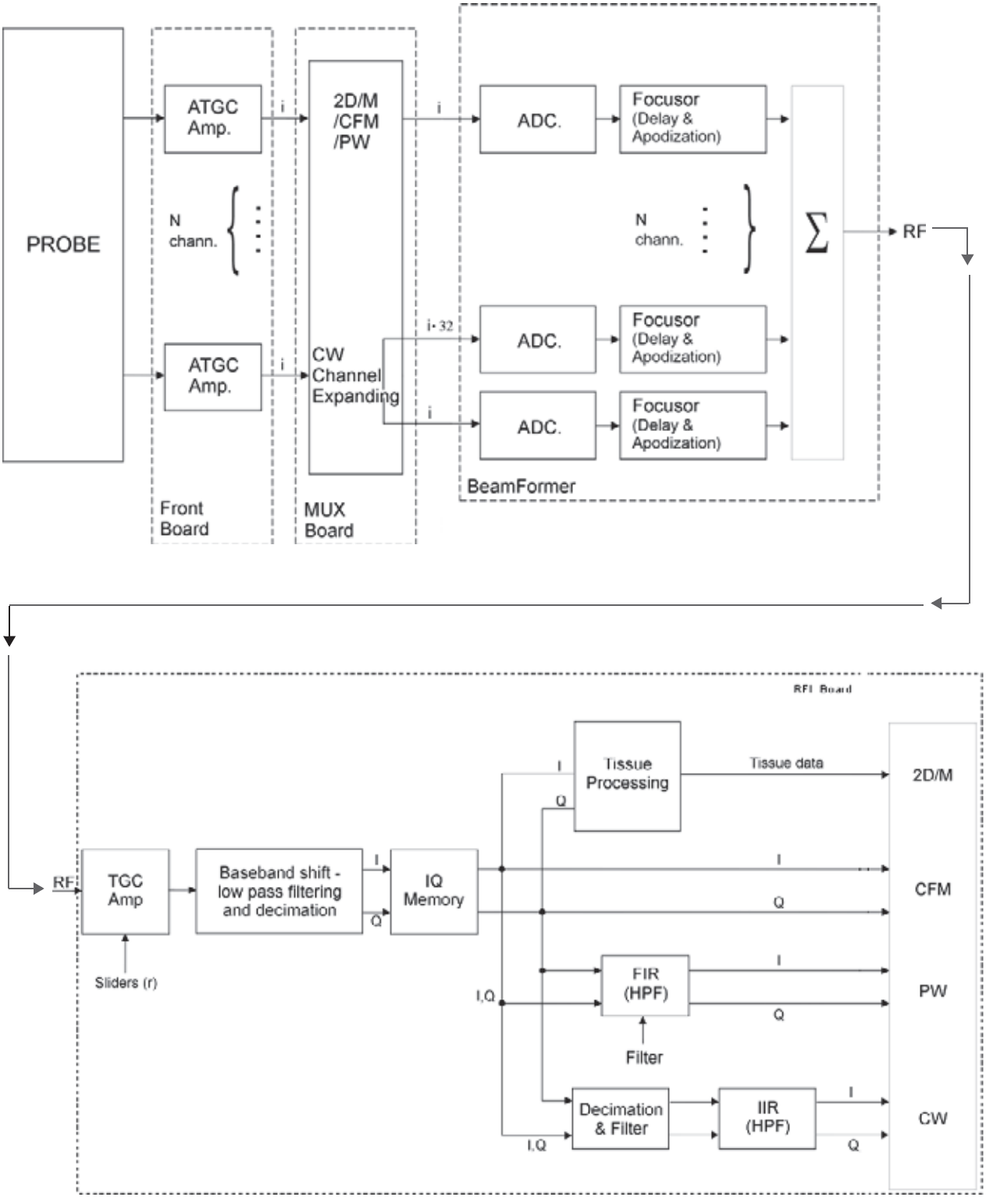

Figure 5-7 Received Signal Path Block Diagram - Systems with RFI Configuration

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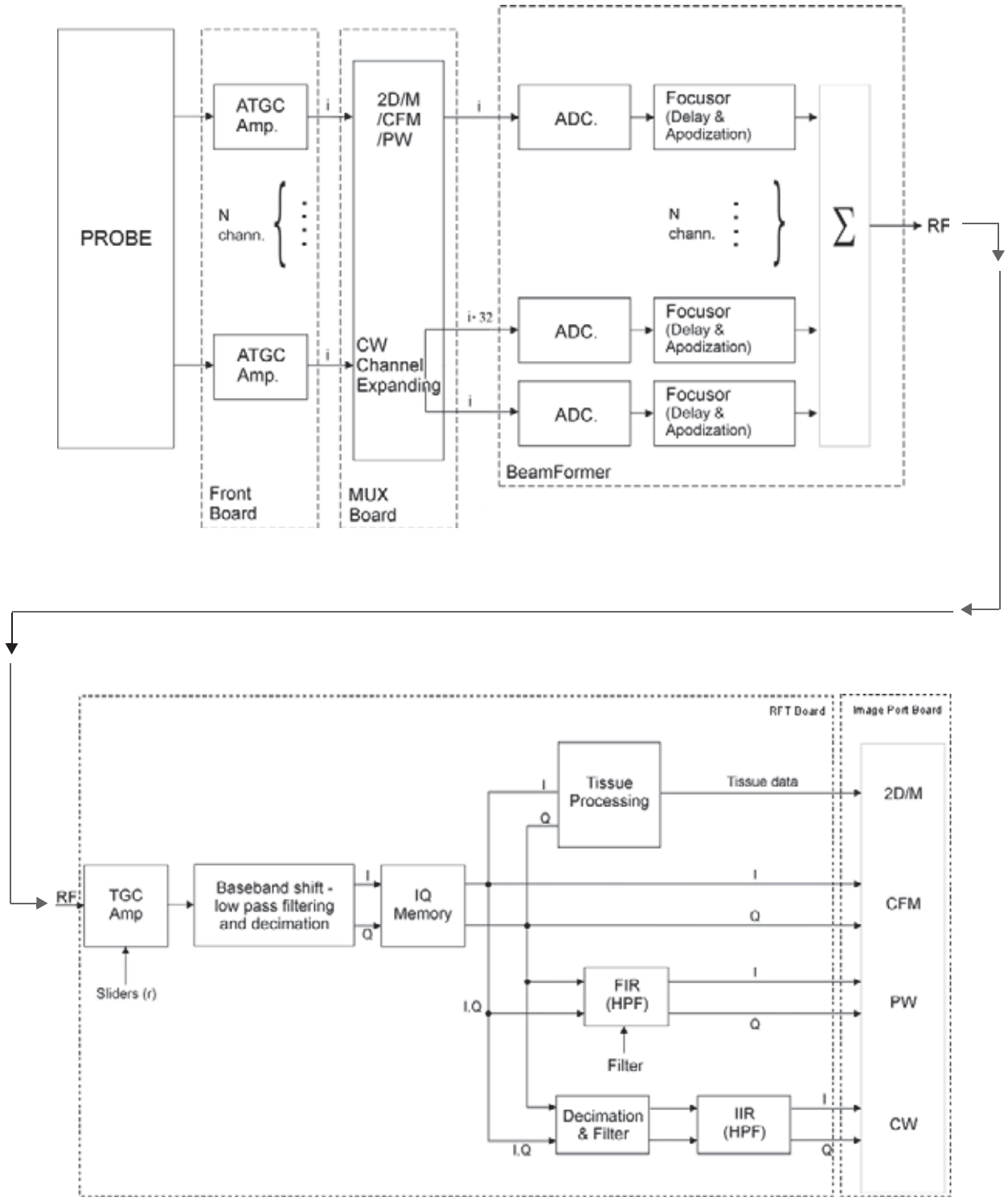

Figure 5-8 Received Signal Path Block Diagram - Systems with RFT Configuration

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5-4-2 Front Board Assembly (FB)

5-4-2-1 General Description

The FB Board has 64 identical receive channels.

The signal in each channel is fed via a Transmit/Receive (T/R) switch to a preamplifier. The next step is a Time Controlled Gain (TGC) amplifier used to equalize the signal strength from the near-field, the mid-field and the far-field.

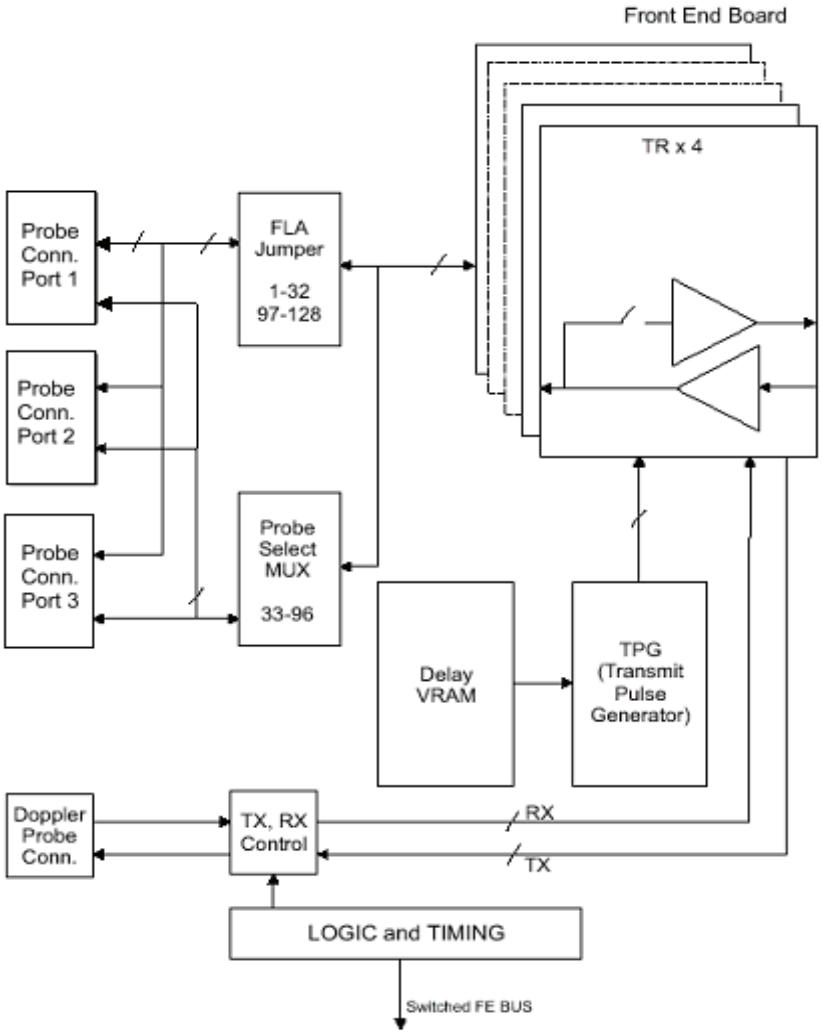

Figure 5-9 Front Board Assembly Block Diagram

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5-4-2-2 TR4 Board Description

The TR4 Board has four transmit and receive signal channels. Each channel has two pulsars for different transmitted Tx voltages, and a low-signal receiver amplifier. Both are connected to the same input/output line. The receiver is buffered from the transmitted voltage (up to 80V) by an electronic switch to avoid high voltage on the receiver input.

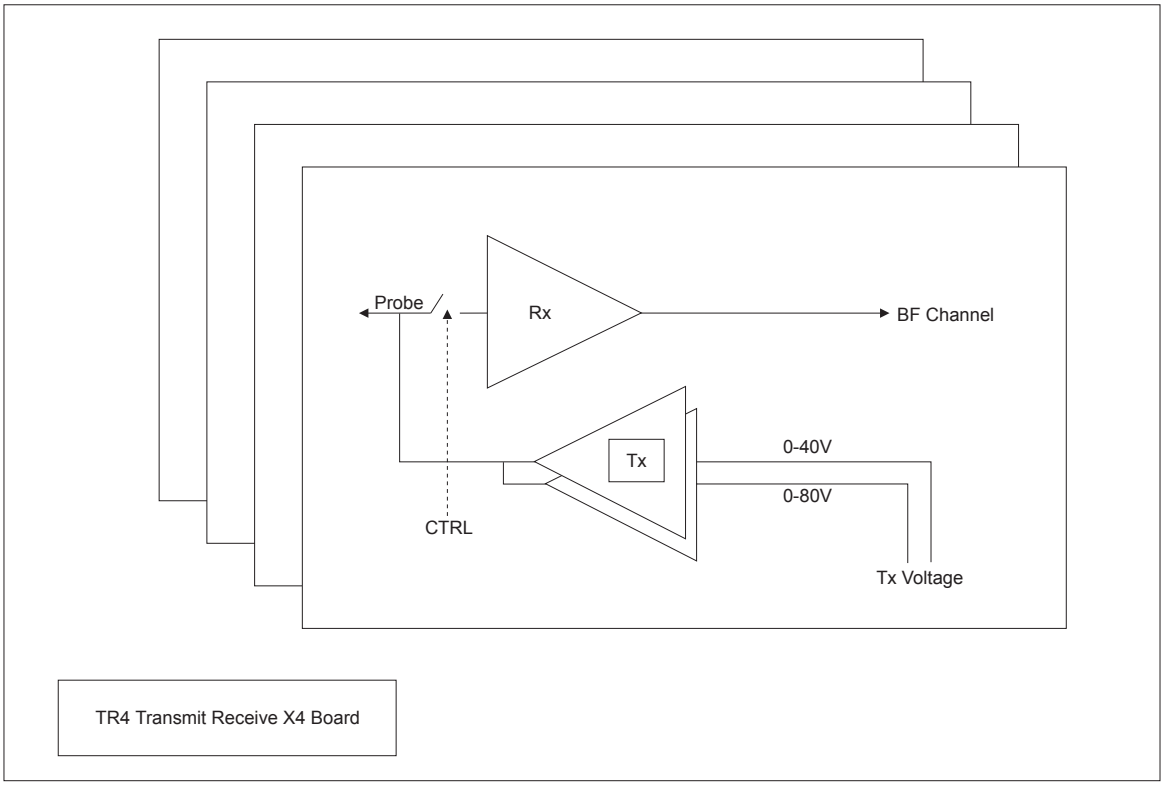

Figure 5-10 TR4 Board Block Diagram

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5-4-3 MUX Board

5-4-3-1 General Description

The MUX Board has 64 identical receive channels, and performs the following functions:

- Receiving the channels and connecting them to the BF Boards.
- Expanding the low/high channels in CW mode.
- TEE motion control.
- Monitoring temperature and voltage measurements via the I²C.
- FE Bus switch. To reduce the noise in the FE cards, the MUX switches off the FE Bus to the FB during the data acquisition in CW mode.
- Min/max AC input monitoring, every ten seconds.

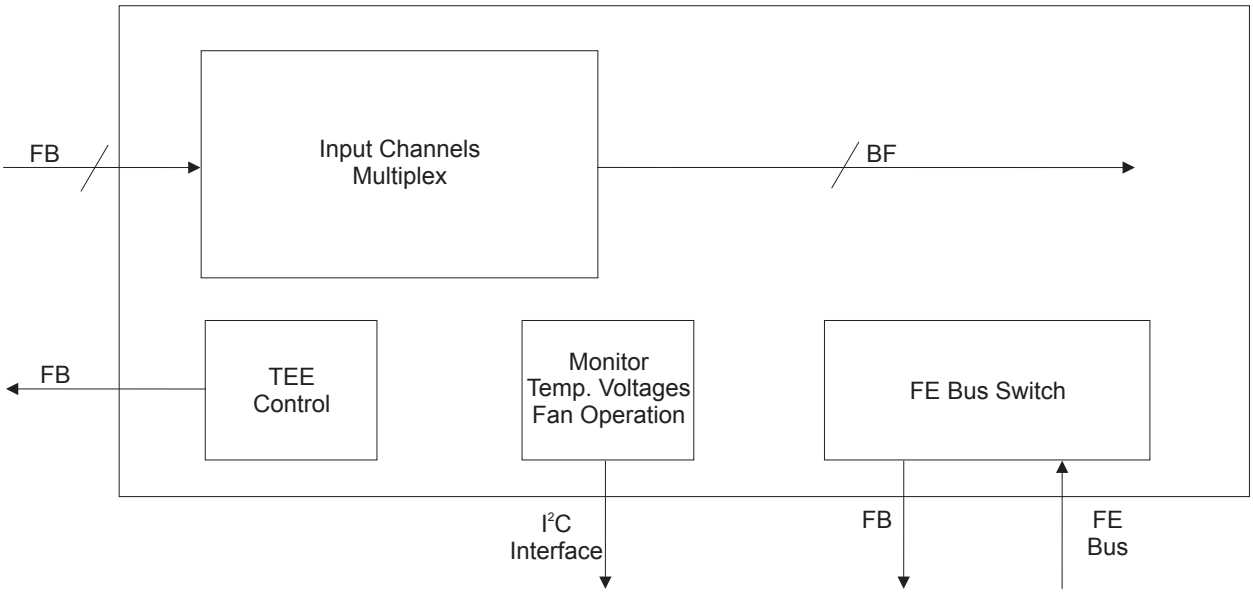

Figure 5-12 MUX Board Diagram

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5-4-4 Beamformer Board (BF)

5-4-4-1 General Description

The Beamformer Board (BF Board) contains the A/D converter, the ASIC (called the Focuser [FOC]) and a Beam Adder (BA). The BF Board accepts input channels and converts each channel to digital bytes.

The system requires one BF Board which scans 64 channels.

The digitized samples at the ADC output are input to the FOCs, whose outputs go to a BA. The output of the BA (BA Level 2) is the sum of the input channels, which is added together with the output from the other BA Level 2, as shown in Figure 5-14 on page 5-19.

These ASICs will add all the input and output channels, with appropriate delay, to give optimal receive focusing and beam steering as a function of time. All focusing and steering parameters for a scan are stored in VRAM on the BF Board. The output of the BF Board is a high-frequency digital Word update. This output can be added to any successive board, if more channels are required.

- **BF Calibration:** The system has a calibration procedure for the BF Board, which sets the offset voltage for the ADC on the BF Board. If the BF Board is replaced, the calibration procedure has to be performed, as described in Beamformer Calibration on page 6 - 17.
- **BF Board Location:** The BF Board can be placed in the Front End Crate, in the third slot from the left side.

5-4-4-2 Description of Operation

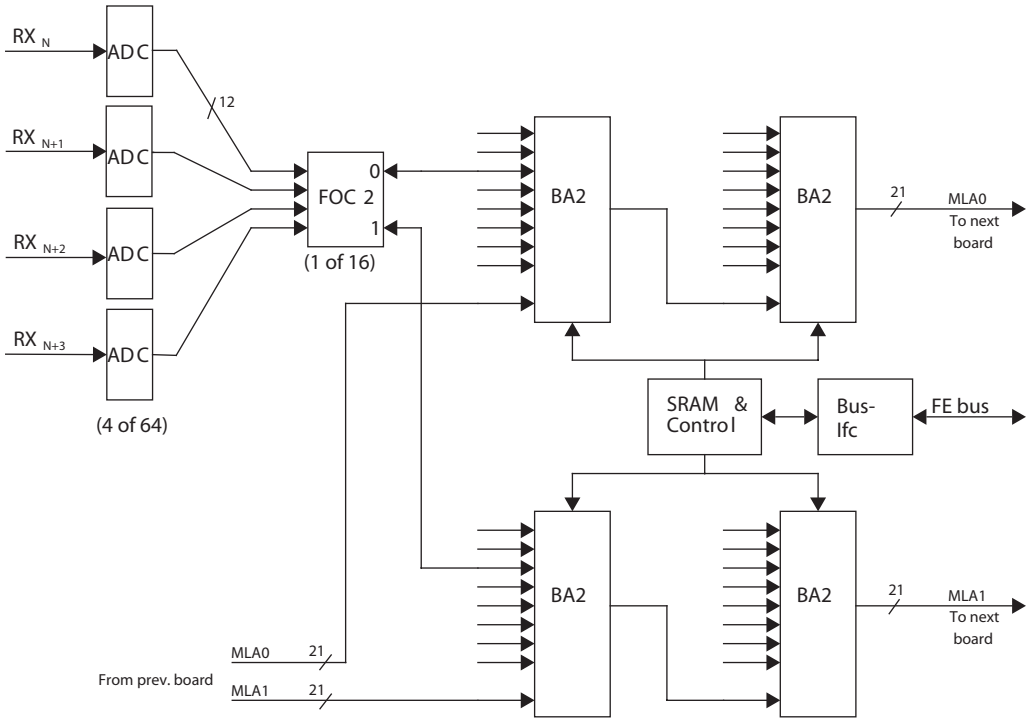

Figure 5-14 Beamformer Board (32 Channel) Block Diagram

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5-4-5 Radio Frequency Interface (RFI) Board

5-4-5-1 General Description

The Radio Frequency Interface (RFI) board has been introduced in the manufacture of Vivid™ 4 systems, as a result of certain hardware components having become obsolete.

The functionality of the following boards is implemented on the RFI board:

- Front-End Controller (FEC) board
- RF & Tissue (RFT) board
- Image Port (IMP) board

NOTE: On Vivid™ 4 systems with the RFT configuration, the FEC, RFT and IMP board functionality is still implemented on the BEP via separate boards. These are described in this chapter in the following sections: Front End Controller Board (FEC) (RFT) on page 5-23; RF and Tissue Processor Board (RFT) on page 5-24; Image Port Board (IMP) on page 5-25.

Tasks Performed by the RFI board:

- System Master Clock generator
- Transmitter Control
- ATGC Control
- Receive Focusing Control
- Analog Test Signal Generator
- High Voltage Control and supervision
- Probe Sensing
- Control of MUX board, Front Board, and Beam Former
- Temperature Sensing for TEE probes
- Step Motor Control for TEE probes

5-4-5-2 Signal Flow

The digitized signals from the Beam Formers are connected to the RFI module. The Digital Signal Processor on the RFI board, together with software on the BEP, performs the adequate signal conditioning for the different data types; *Tissue*, *Doppler* and *Color Flow*.

In addition, Doppler Audio Processing is performed by the RFI board. (The Doppler Spectrum Processing is done by the BEP).

The RFI extracts Tissue Data, Spectrum Data and IQ & Color Data from the digital data stream on its input, and it also performs RF filtering and different types of Tissue Processing.

5-4-5-3 RF Processing

Different types of RF processing is performed, depending on later usage of the data:

- RF Demodulation
- Digital Time Gain Compensation
- Filtering
- Decimation

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5-4-5-4 Data Buffer

After RF filtering, the data is written into different sliding ring buffers, dedicated to the different types of data. While data is written into the buffers sample-by-sample in vectors, multiple samples from the same range (depth) can be read out.

Both input addressing (start and length) and output addressing (through output events) are controlled by the RFI board itself.

5-4-5-5 Tissue Processing

A number of different tissue processes are performed on the RFI board:

1.) Firstly, the signal amplitude is obtained by *detection*.
2.) Then the data is compressed to attenuate the strong signals and amplify the low level echoes.
3.) After compression, *Zone Stitching* is performed. Zone Stitching is used to combine the (transmit) focal zones from different vectors into one vector by weighting the zone transitions, and only applies to phased/linear array probes where multiple vectors can be collected in the same direction. For M-Mode, *peak detection* and *edge enhancement* is implemented.
4.) Finally, in some cases, an offset can be added to the signal and clipping is performed.

5-4-5-6 Color Flow Processing

No Color Flow processing is performed here, except for the RF demodulation previously mentioned. The data used for Color Flow is tagged with the appropriate headers and tails and sent to the Back-End Processor (BEP).

5-4-5-7 Doppler Data

On the RFI board, Doppler Data is high pass filtered (to remove strong low frequencies returned from wall motion, valves and leaflets) and then sent to the BEP, and to Audio Circuitry on the KB Control Board.

5-4-5-8 System Temperature Surveillance

The RFI board monitors the temperature in the airflow at the air intake, and in the airflow at the air outlet.

These measurements make it possible to monitor the environmental conditions (temperatures) for the scanner and prevents overheating.

5-4-5-9 Probe Management

The RFI board performs the following probe management functions:

- Controls the selection of a probe connector
- Senses the Probe *type*
- Senses the Scan Plane Angle on MPTE and PAMPTE probes
- Senses the Probe *temperature*
- Turns OFF the probe if the temperature exceeds the *maximum* temperature.
  The temperature references are set to 41.3 ^{o}C and 43.0 ^{o}C.
- Turns OFF the probe if the temperature reading falls below *minimum* temperature
  The minimum temperature references is set to15 ^{o}C. A temperature reading as low as 15 ^{o}C indicates a probe temperature-sensing error.

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5-4-5-10 TX Power Supply Management

The TX Power supply has two separate voltage outputs, as follows:

- **TX Power Supply #1 (TX1)** - generates voltage levels for pulsed TX operations
- **TX Power Supply #2 (TX2)** - generates voltage levels for both pulsed and CW operations

The RFI sets the voltage level for the two TX Power Supply outputs (*TX1* and *TX2*) and also measures the voltage levels and current drain from the two TX outputs. If any of the values *exceed* the limit for a given mode, the RFI will turn OFF power to the probe.

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5-4-6 Front End Controller Board (FEC) (RFT)

The Front End Controller (FEC) Board controls other boards in the Front End Crate. The control is done through a synchronous and bidirectional Bus called the Front End Bus. The following tasks are performed by the FEC Board:

- System master clock generation (including clock to IP).
- Transmitter control.
- ATCG control.
- Receive focusing control.
- Analog test signal control.
- Probe sensing.
- Transmit voltage control.
- Control of Front Board switching.
- Temperature sensing for the TEE probes.
- Memory refresh control for the BF Board.
- Provide 40 MHz clock to IP.

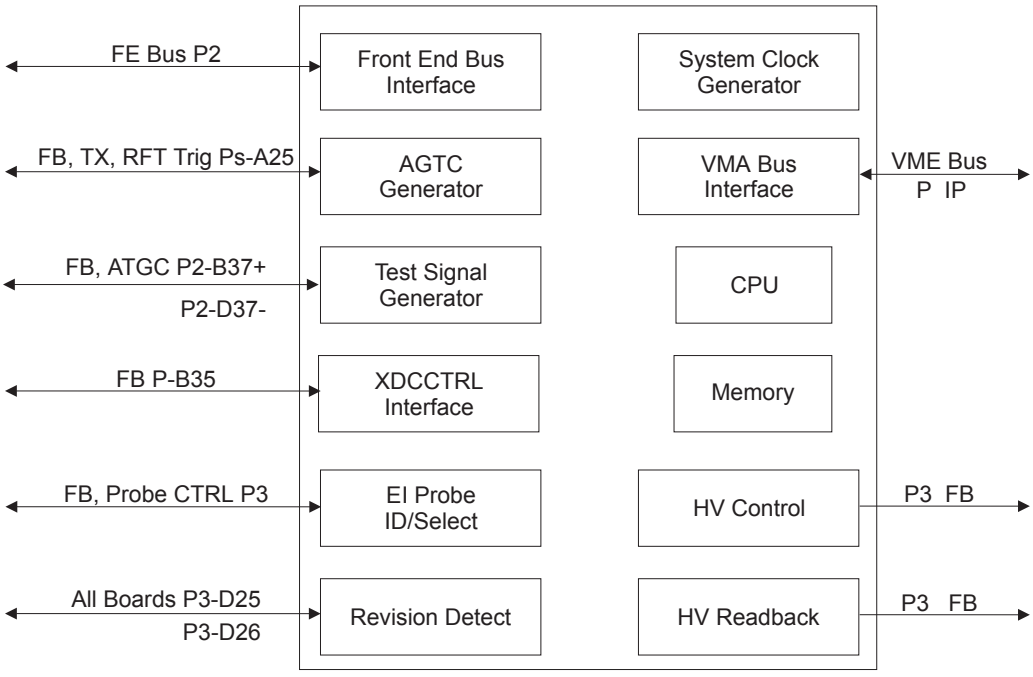

Figure 5-1: Front End Controller Block Diagram

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5-4-7 RF and Tissue Processor Board (RFT)

The RF and Tissue Processor Board (RFT) receives data from the BF1 Board in the Front End. Both types of data samples (RF_MODE) are communicated to the RFT Board from the Front End Controller Board, via the Front End Bus.

5-4-7-1 Control

The RFT Board has a local DSP with an external EPROM. The DSP performs the following control tasks:

- Handles communication with the BE over the VME Bus and the PCI Bus.
- Updates filter coefficients and other parameters in the data path.
- When output events are received from the FEC, the RFT Board sets up the pipe link to output control, for data tagging and transfer.
- During transfer of time motion data, the RFT Board creates a “time slot” data transfer, which replaces the output event base transfer.

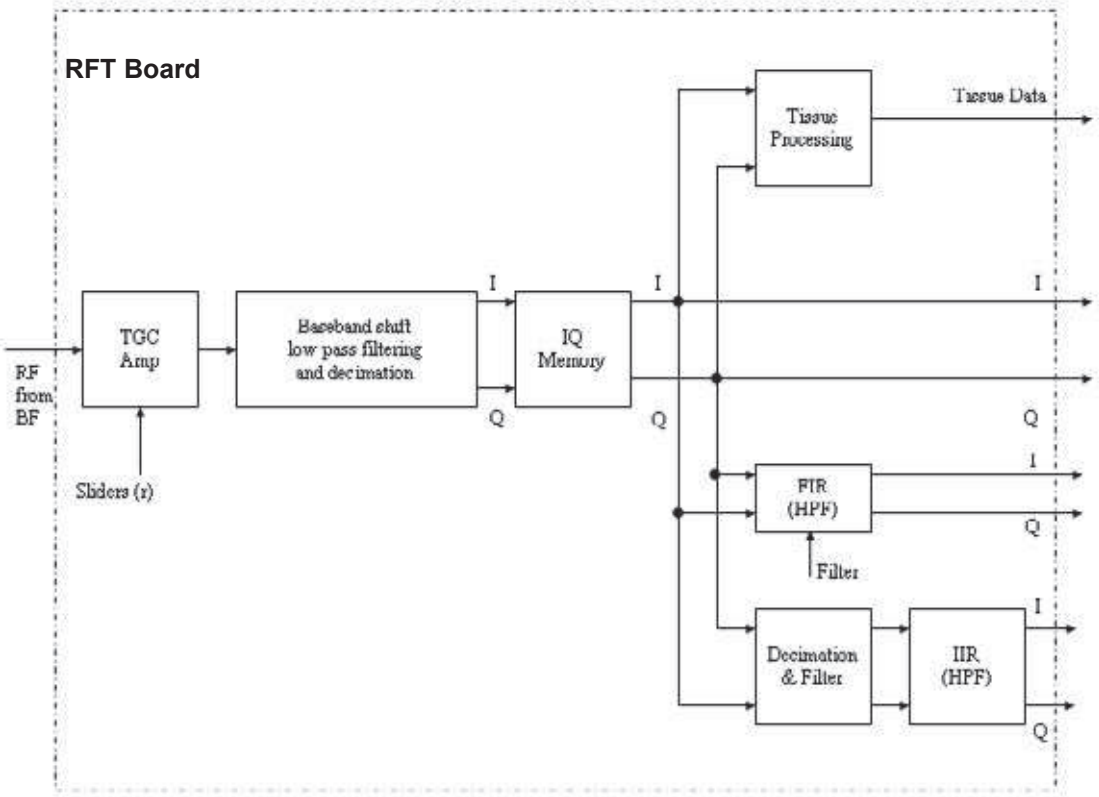

Figure 5-17 RFT Processor Board

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5-4-8 Image Port Board (IMP)

The function of the Image Port (IMP) is to receive signals from either the RFT (during scanning) or the VCR (during playback), capture them, and route them to the Back End Processor (BEP) via the PC2IP Bus. The IMP handles all the communication from the BEP to the Front End Cards and back through the VME Bus - see Figure 5-18 below.

The IMP is used as a connection to the BEP. All the instructions to the Front End Crate are sent via the IMP, and all the outgoing data is transferred to the BEP via the IMP through the PCI Bus.

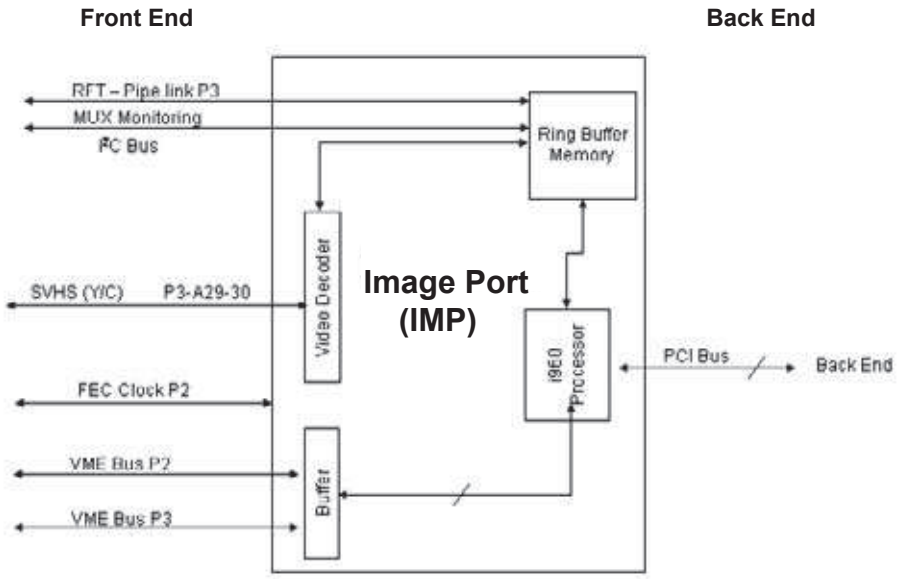

Figure 5-18 Image Port Block Diagram

5-4-9 Back Plane Board (Motherboard)

The Back Plane Board serves as a mother board which connects all the boards' signals. It also distributes the low voltages for the FE Crate boards and the TX voltages. It hosts all the FE boards, as shown in the following figures:

- Systems with **RFI Configuration** - see Figure 5-1 on page 5-8.
- Systems with **RFT Configuration** - see Figure 5-2 on page 5-9.

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Section 5-5
Back End Processor

5-5-1 Introduction

The Back End Processor (BEP) supports the operation of the Vivid™ 3 ultrasound unit and is the main controller for the unit. The BEP comprises the various components described in the following sections:

- Central Processing Unit (CPU) on page 5 - 31.
- Keyboard Controller on page 5 - 34.
- Frame Grabber (RFI systems only) on page 5 - 35.
- PC2IP on page 5 - 35.
- Plug and Scan Card and Battery on page 5 - 35.
- Network Onboard on page 5 - 35.-
- SCSI Card on page 5 - 35.
- Floppy Drive on page 5 - 36.
- Hard Disk on page 5 - 36.
- Magneto-Optical Drive (MOD) on page 5 - 37.
- CD Read Write (CDRW) on page 5 - 37.
- ECG Module on page 5 - 37
- Modem on page 5 - 38.
- PC-VIC Assembly on page 5 - 39.

Figure 5-19 on page 5-27 shows the location of the various components within the BEP for BT02/BT03 systems with the RFI configuration. For systems with the RFT configuration, see Figure 5-20 on page 5-28.

A block diagram of the BEP in Vivid™ 3 systems with the RFI configuration is provided in Figure 5-21 on page 5-29. For systems with the RFT configuration, see Figure 5-22 on page 5-30.

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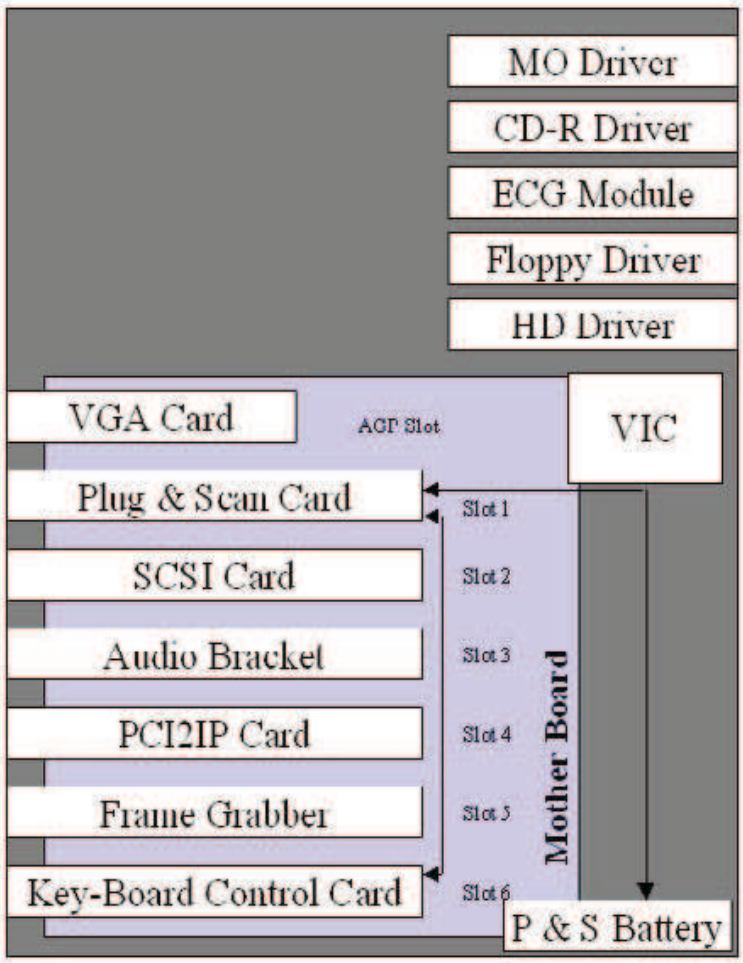

Figure 5-19 Back End Component Locations - BT02/BT03 (RFI Configuration)

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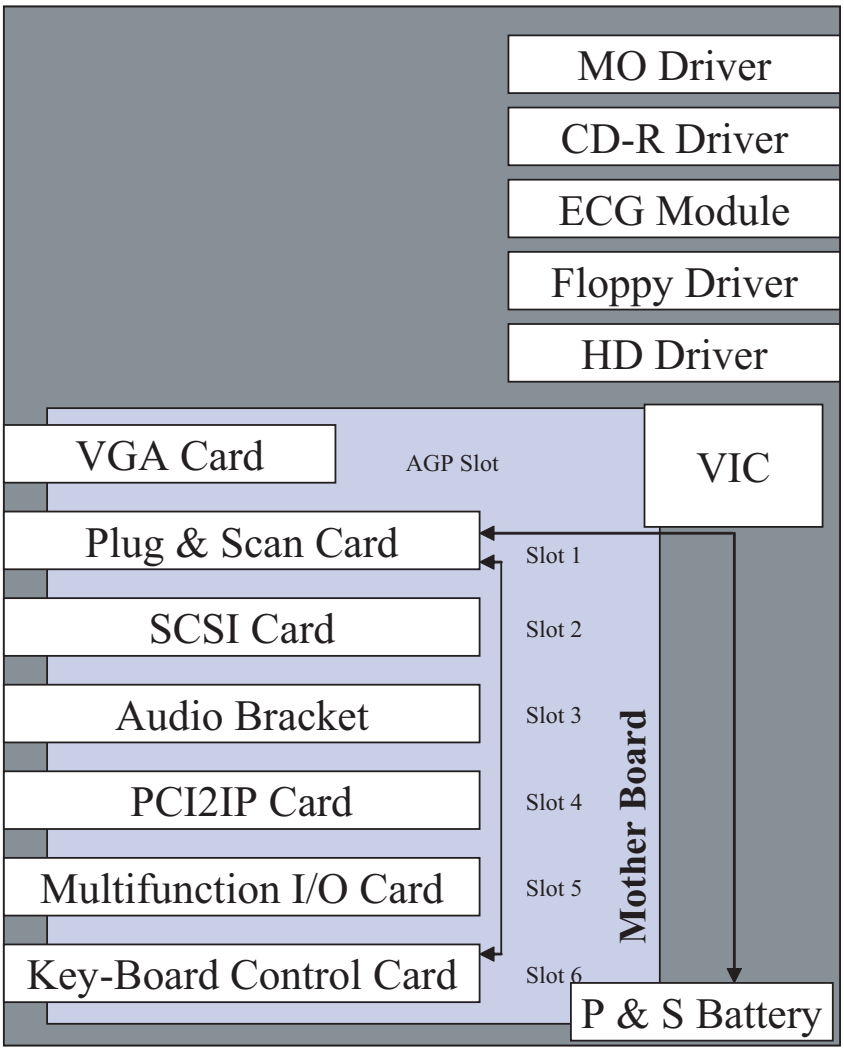

Figure 5-20 Back End Component Locations - BT02/BT03 (RFT Configuration)

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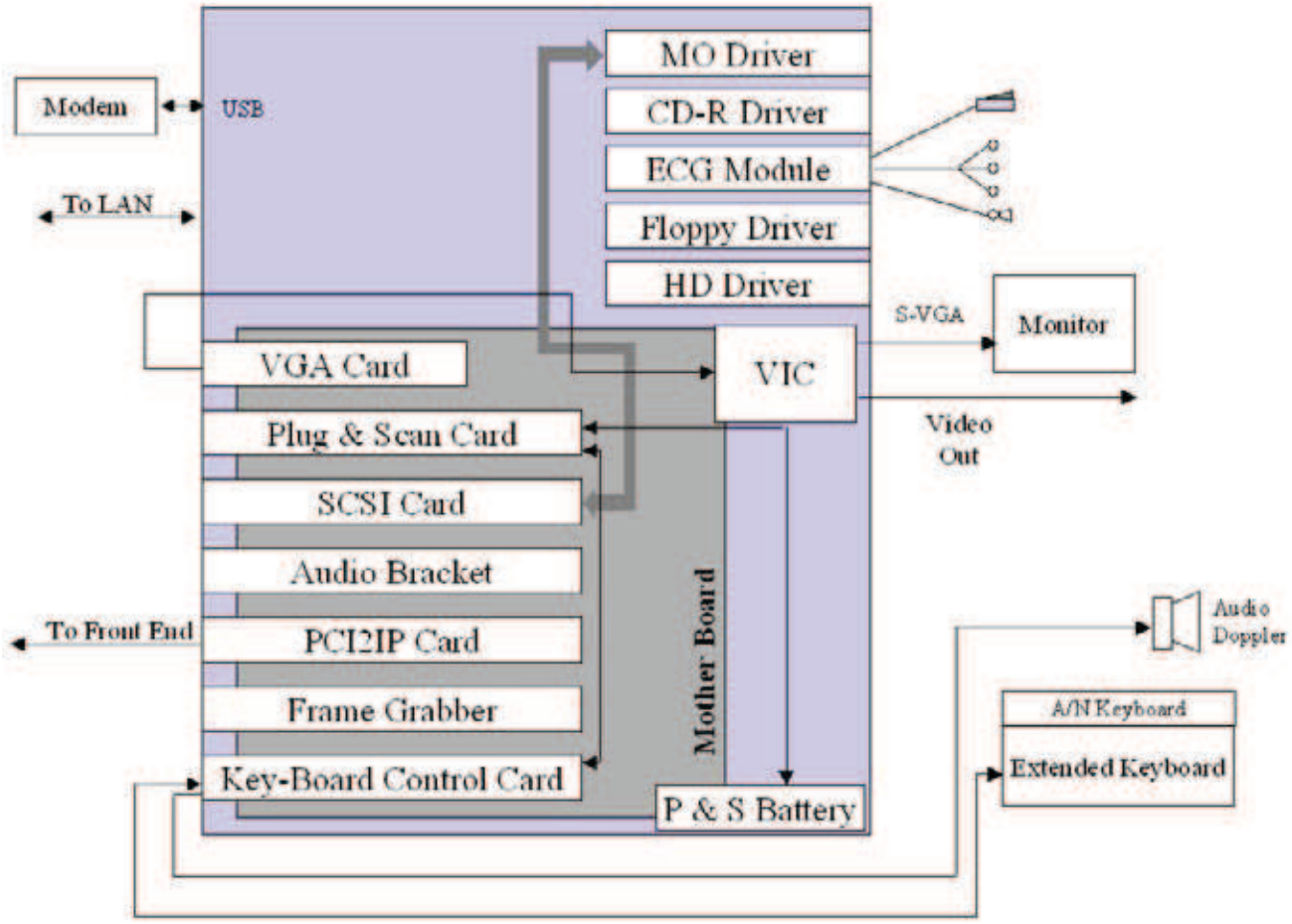

Figure 5-21 Back End Block Diagram - BT02/BT03 (RFI Configuration)

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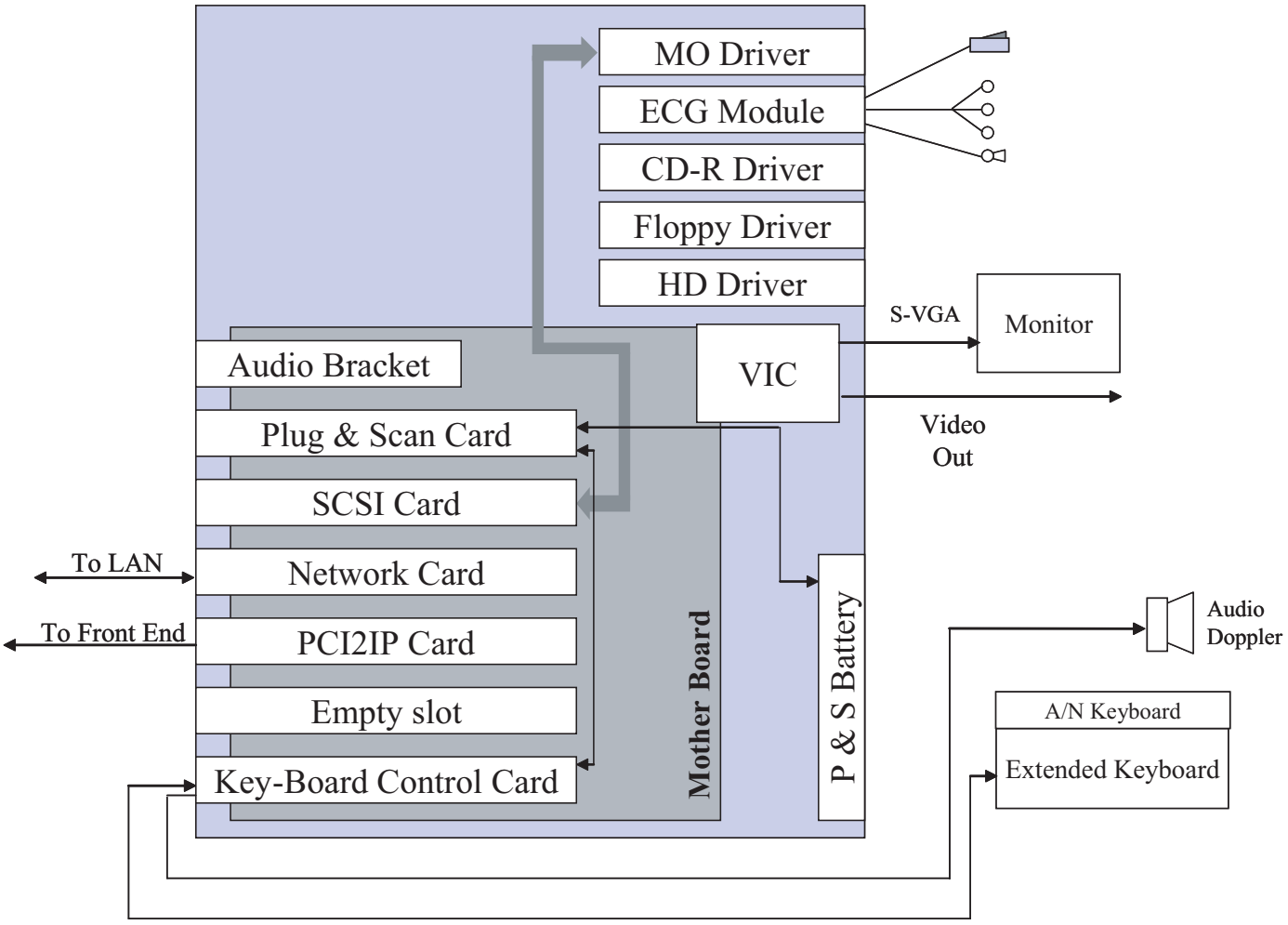

Figure 5-22 Back End Block Diagram - BT02/BT03 (RFT Configuration)

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5-5-2 Central Processing Unit (CPU)

The CPU controls and processes the internal Back End Processor operations. In addition, the CPU supports the Front End Crate via the IP card. The CPU used in the Vivid™ 3 ultrasound unit is a Pentium 4, 2 GHz Intel Processor, or newer. On older units (Pentium III) the CPU is I GHz.

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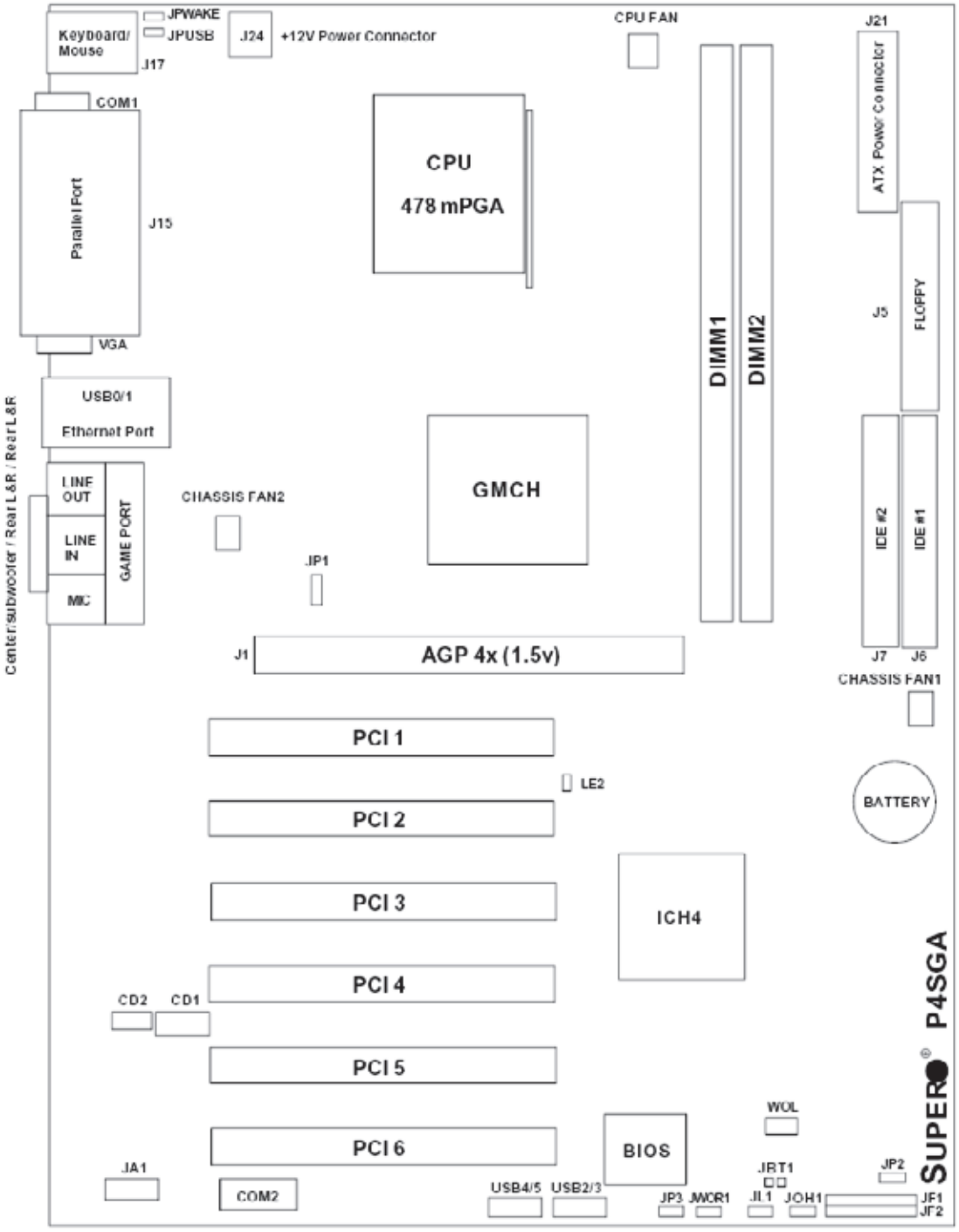

Note: Not drawn to scale

Figure 5-23 BEP Motherboard Layout - BT02/BT03

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Table 5-6 BEP Motherboard Layout BT02/BT03 - Legend to Figure 5-23

Jumpers	Description	Default Setting
BT1	CMOS Clear	Open (Disabled)
JP1	Front Side Bus Speed	Pins 1-2 (Auto)
JP2	Watch Dog Enable	Open (Disabled)
JP3	Speech Output Select	Pins 1-2 (Speaker)
JPUSB	USB0/1 Wake Up	Pins 1-2 (Disabled)
JPWAKE	Keyboard Wake-Up	Pins 1-2 (Disabled)
Connectors	**Description**	
CD1	Audio CD Input (large connector)	
CD2	Audio CD Input (small connector)	
Chassis Fan1/2	Chassis Fan Header	
COM1/COM2	COM1/COM2 Serial Port Connector/Header	
CPU Fan	CPU Fan Header	
DIMM1/2	Memory (DIMM) Slots	
Ethernet	LAN (Ethernet Port)	
Game Port	Game Port	
J1[a]	4xAGP	
J5	Floppy Disk Drive Connector	
J6/J7	IDE #1/#2 Hard Disk Drive Connectors	
J15	Parallel Printer Port	
J17	PS/2 Keyboard/Mouse	
J21	ATX 12V Power Connector (20-pin)	
J24[b]	ATX 12V Power Connector (4pin)	
JA1	SPDIF Connector	
JF1, JF2	Front Control Panel	
JL1	Chassis Intrusion Header	
JOH 1	Overheat LED	
JWOR1	Wake-On-Ring Header	
LE2	5v Standby Warning LED	
LINE IN	Audio In Connector	
LINE OUT	Audio Out (Speaker) Connector	
MIC	Microphone Input	
USB2/USB3	Universal Serial Bus Port 2/3	
USB4/USB5	Universal Serial Bus Port 4/5	
WOL	Wake-On-LAN	

a. P4SGA only

b. The 4-pin connector at J24 must be connected to meet the safety requirements of the ATX 12V specifications.

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5-5-3 Keyboard Controller

The keyboard controller controls all the extended keyboard operations, power management systems and audio control.

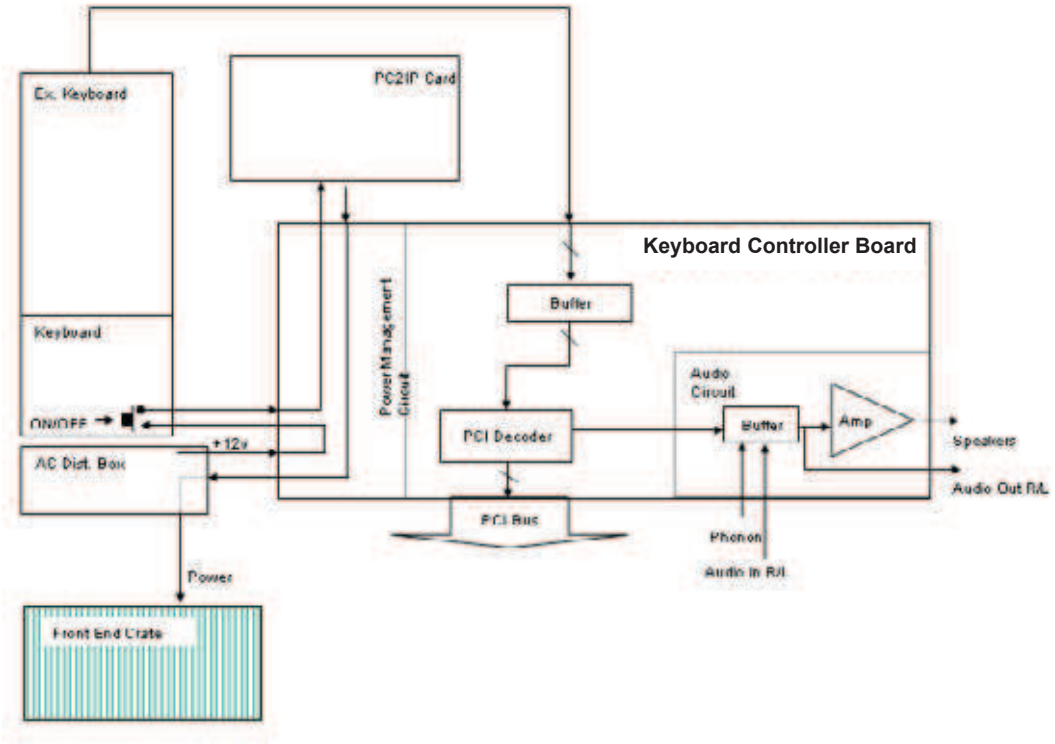

Figure 5-24 Keyboard Controller Block Diagram

The Keyboard Controller contains the Audio Amplifier that controls the volume of the front cover speakers. The Keyboard Controller also contains a power management system to enable three shut-down modes:

- **Hard Shutdown**, by pressing the ON/OFF button continuously for more then 10 seconds. This is for emergencies only and should not be used under regular circumstances.
- **Standby Mode**, which enables system boot-up in 30 seconds (this option is enabled if the Plug & Scan option is installed, allowing you to move the unit from one location to another).
- **Full Shutdown**, which then requires more than 2 minutes to boot up.

There are three main keyboard components:

- **External Keyboard:** All the soft keys, whose functionality changes according to the selected menu.
- **Trackball:** Operates in a similar manner to that of a PC mouse pointer.
- **Alphanumeric Keyboard:** The normal keyboard including the function keys and numbers to enable text writing and other functions.

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5-5-4 Multifunction I/O Controller

The Multifunction I/O Controller provides two additional serial COMs, COM3 and COM4, that are used to support the modem functions.

5-5-5 Frame Grabber (RFI systems only)

The Frame Grabber (see Figure 5-25 below) grabs the YC video signal from the VCR Output and converts it to PCI data, allowing the system to present playback images from the VCR recording.

NOTE: This operation was previously handled as a function of the Image Port on Vivid™ 4 systems with the RFT configuration.

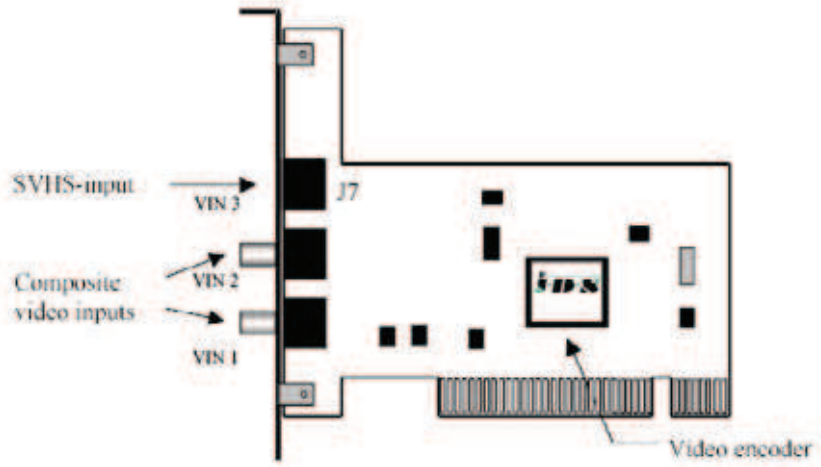

Figure 5-25 Frame Grabber - Vivid™ 4 BT03 Systems with RFI Configuration

5-5-6 PC2IP

The PCI2IP enables the transfer and reception of data and control signals between the Front End Crate and the Back End Processor via the Image Port Board. The PC2IP adapts data from the IP to the PCI Bus of the CPU. The PCI2IP is sometimes referred to as the PCI Bridge.

5-5-7 Plug and Scan Card and Battery

The Plug Scan enables the Standby Mode during Plug and Scan operations, and performs a legal shutdown of the operating system when the power lines go below preset values. The P&S does not support the operation of the unit during a power failure, but rather enables the shutdown of the Back End Processor to Standby Mode and supports Standby Mode while there is no power supply. The P&S battery degrades with time and should be replaced, as described in *Chapter 10 - Periodic Maintenance*.

5-5-8 Network Onboard

The Network Onboard enables the Vivid™ 3 to operate in a standard LAN network (EchoPac environment), which enables the system to connect to external applications, saving or retrieval of data from network residents.

5-5-9 SCSI Card

The SCSI Card supports the operation of the MOD. The SCSI Card is situated on the PCI Bus of the CPU, and is controlled by the CPU.

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5-5-10 Floppy Drive

The Floppy Drive supports basic data retrieval from the Vivid™ 3 ultrasound unit, such as log files, export to Microsoft Excel, small image files and other service utility operations. The floppy drive is controlled by the CPU via signals from the IDE Bus. The floppy drive can support media format not larger than 1.44 MB size 3.5 in.

5-5-11 Hard Disk

The Hard Disk is the main storage device of the Vivid™ 3 ultrasound unit. The Hard Disk is controlled by the CPU via signals from the IDE Bus.The Hard Disk is partitioned into four drives, each of which is designated for different operations, as follows:

- **C: Drive:** Execution of the operating system and the software application, and factory presets. The partition size 2Gbyte.
- **D: Drive:** User presets and data. The partition size is 1Gbyte.
- **E: Drive:** Archiving of all images and reports. The partition size is normally 15.5Gbyte but this depends upon the size of the hard disk.
- **F: Drive:** Swap file partition for future usage. The partition size is 550Mbyte.

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5-5-12 Magneto-Optical Drive (MOD)

The MOD is used to back-up images and reports. Backing up enables storage of the images and reports for future review on Vivid™ 3 ultrasound units, or other EchoPac-compatible devices. The MOD is controlled by the CPU via the SCSI Card. Only 2.3 MB media are EchoPac (DICOM)-compatible with EchoPac devices. Magneto-Optical media of any other size may be used for back-up, but will only be compatible with DICOM.

5-5-13 CD Read Write (CDRW)

The CDRW is used to back-up images and reports, in the similar way as the MOD. In addition, the CD is used as the main source of software upgrades and other service utility operations. The CDRW can write to 24X speed CDs or above, and can read all types of CDs. The CDRW is controlled by the CPU via the IDE Bus.

5-5-14 ECG Module

The ECG Patient I/O module is used to track and convert the ECG signal either via Internal ECG leads or External sources. In addition, the ECG module provides an interface to Microphone input and FootSwitch pedal. The Foot switch is a pass-through to the keyboard functions, while the other functions are communicated to the BEP via the Com2 serial port of the BEP. The Internal leads of the ECG are optically isolated to fit FAD standards.

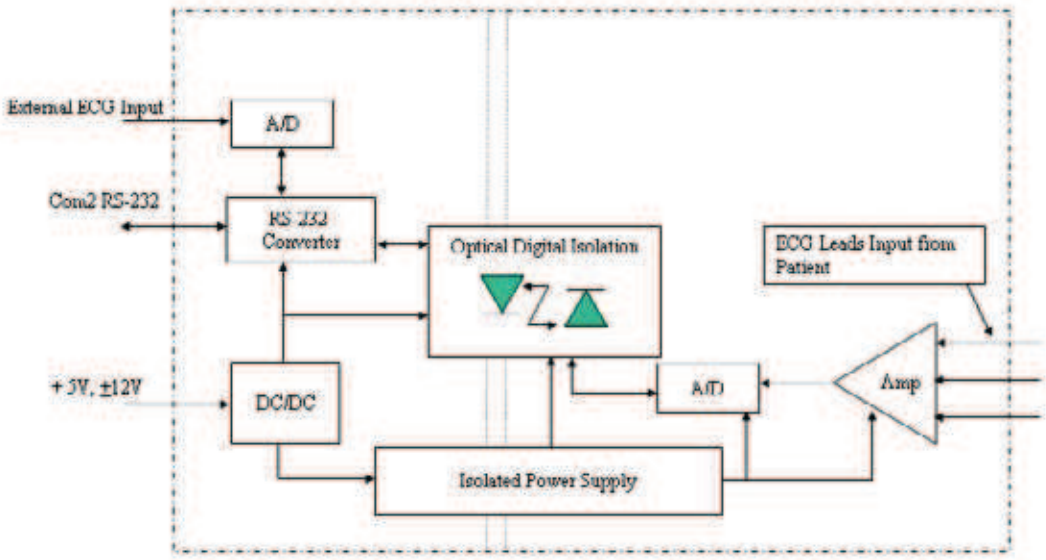

Figure 5-26 ECG Patient I/O Module

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5-5-15 Modem

The Modem is a universal modem controlled by the CPU via the USB port. The modem is used for iLinq (InSite) remote servicing. This is a standard MultiTech modem that connects to an analog phone line.

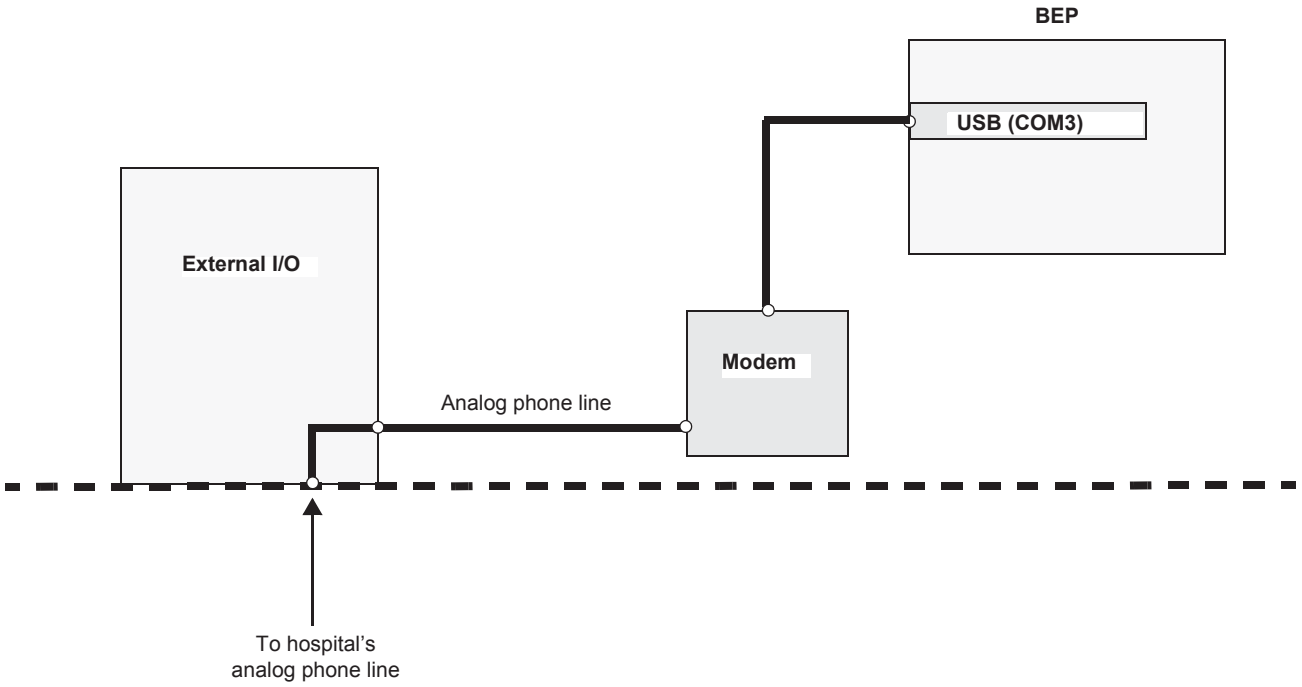

Figure 5-27 Modem Block Diagram

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5-5-16 PC-VIC Assembly

5-5-16-1 General Description

The PC-VIC assembly comprises the PC-VIC board and the I/O board.

The I/O board contains inputs and outputs; it receives all input signals, filters them, and transmits them either to another external peripheral or to the PC-VIC board.

The PC-VIC board receives input signals from the VGA board and the PC2IP board. The VGA board transmits SVGA signals which are filtered and transmitted to the Control Console Monitor. The SVGA RGB signals are transmitted into the Video Input and Capturing circuit, where they are conditioned, and only part of the transmitted image is captured and transmitted (in RGB format) to the S-Video C-Video Converter circuit and to the RGB to Color Printer Converter circuit.

The PC2IP board controls the PC-VIC Power-on and also controls the operation of PC-VIC via an I^2C signal generated from the PCI bus of the BEP. The I^2C signal determines the operation of the Video Input and Capturing circuit and gives the command whether to operate in PAL or NTSC. It also defines which region of the image is to be captured.

The RGB to Color Printer Converter circuit receives an RGB signal from the Video Input and Capturing circuit and converts it to fit the level of RGB Color Printer standards.

The S-Video C-Video Converter circuit receives an RGB signal from the Video Input and Capturing circuit and converts it into S-Video C-Video and sends a feedback signal to the Video Input and Capturing circuit.

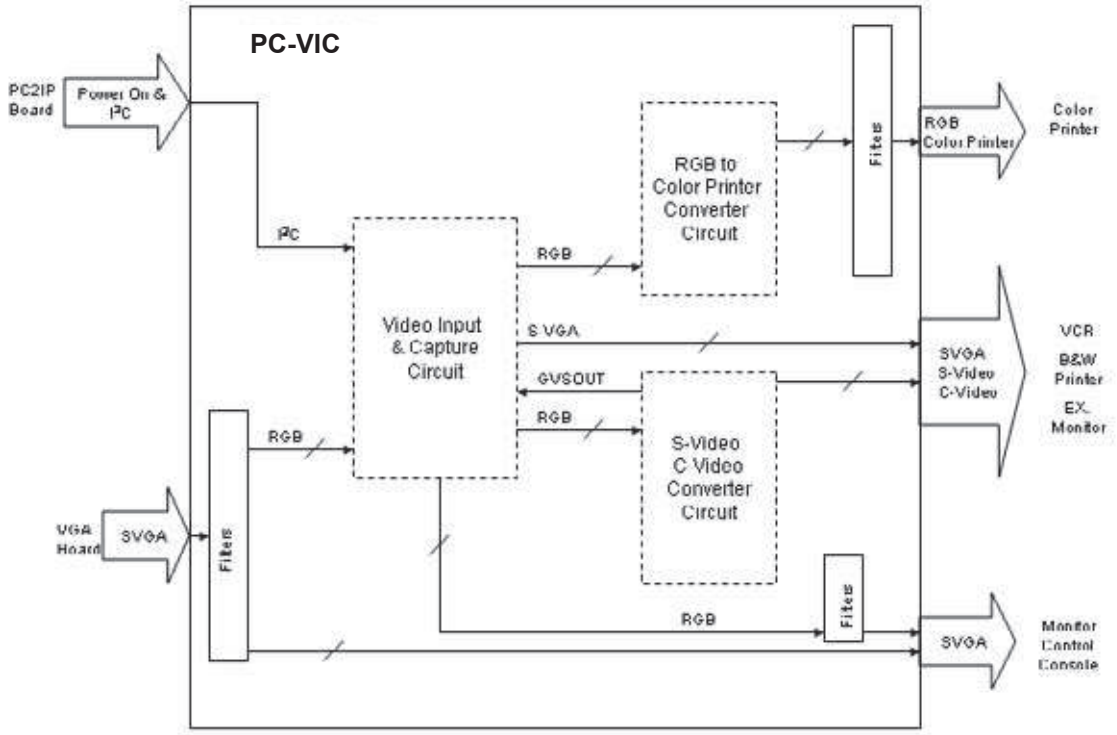

Figure 5-28 PC VIC Block Diagram

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5-5-16-2 PAL

Table 5-7 PAL Video Specifications

Horizontal Timing		
Horizontal Total (HT)	us	944 pixels
Horizontal Start (HS)	us	152 pixels
Horizontal Active (HA)	us	768 pixels
Pixel Clock Freq	14.7 MHz	(PAL)
Vertical Timing (Interlaced)		
Vertical Start (VS)	53 Lines / field	
Active Lines (VA)	Lines / frame	(=PAL standard)
Total Lines (VT)	625 Lines / frame	(=PAL standard)
Frame Rate	25Hz	(=PAL standard)

5-5-16-3 NTSC

Table 5-8 NTSC Video Specifications

Horizontal Timing		
Horizontal Total (HT)	us	780 pixels
Horizontal Start (HS)	us	118 pixels
Horizontal Active (HA)	us	640 pixels
Pixel Clock Freq	12.272725 MHz	(NTSC)
Vertical Timing (Interlaced)		
Vertical Start (VS)	17 Lines / field	
Active Lines (VA)	(525 - 17) Lines / frame	(=NTSC standard)
Total Lines (VT)	525 Lines / frame	(=NTSC standard)
Frame Rate	30Hz	(=NTSC standard)

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Section 5-6
External Peripherals

5-6-1 Introduction

The following external peripherals are used with the Vivid™ 3 ultrasound scanner:

- VCR (connected to Internal I/O)
- Black & White Video Printer (connected to Internal I/O)
- Color Video Printer (connected to BEP - D5)
- Color Inkjet Printer

5-6-1-1 VCR

The VCR operation is controlled from the Control Console, by way of the Keyboard Controller via COM1. The VCR, which receives and transmits Y/C video signals, is used for recording and re-playing exams. The appropriate type of VCR should be used for the local video signal - PAL or NTSC.

5-6-1-2 Black & White Video Printer

The B&W Video Printer receives a Black and White video signal and a trigger signal, and is controlled via the Control Console.

5-6-1-3 Color Video Printer

The Color Video Printer receives an RGB video signal and a synch signal from the VIC. It is controlled by the Control Console.

5-6-1-4 Color Inkjet Printer

The Color Inkjet Printer is used to print out reports and exams and is controlled via the parallel port of the BEP. In the application software, the color inkjet printer is referred to as the *PC Printer*.

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Section 5-7
Vivid™ 3 Power Distribution

5-7-1 Electrical Power

The Vivid™ 3 system can be set up to operate from the following 50/60 Hz AC voltages: 100V, 120V, 220V, 230V and 240V.

The local input voltage is converted to an internal voltage of 230V, via the Trafo. This voltage is distributed to different system components and converted into DC voltages in the BEP and the Front End, to support their operation. Table 5-9 below shows which voltages are used in the various system components, both in the BEP and the Front End.

Table 5-9 Vivid™ 3 - DC Voltage Distribution

End F = Front B = Back	Board / Unit	+3.3V Dig	+5V Dig	+5V Ana	+12V TEE	-5 V Vee	10 V	+15V -15V	Pmx85 n Pmx85 p	±80 V ±40 V	5 V BE	12 V BE	Local 42V LVPS	230V AC Int	Local AC Voltage	3.3 V BE
F	Mother Board		+	+	+	+	+	+	+	+						
F	Probes			+					+							
F	F Board			+		+	+	+	+	+						
F	MUX Card		+	+		+	+	+	+	+						
F	BF	+	+		+	+										
F	FEC	+	+			+										
F	RFT		+			+										
F	IMP		+			+										
F	RFI	+	+			+										
B	KB Controller												+			
B	KB Matrix											+	+			
B	VIC										+	+				
F	DC LVPS										+	+		+		
F	TXPS													+		
	Peripherals														+	
	Display														+	
F	Fans												+			
B	Analog Keyboard										+	+				
B	BE										+	+		+		+

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5-7-2 AC System

The AC System (see Figure 5-30) comprises the following components:

- **AC Isolation Transformer**.
- **AC Distribution Box**, as described in AC Distribution Box on page 5 - 45.
- **AC Input Box**, see AC Input Box on page 5 - 45.
- **Thermal Fuses**, see Thermal Fuses on page 5 - 45.

Refer to Figure 5-29 below for RFI-configured systems; for RFT-configured systems, see Figure 5-30 on page 5-44.

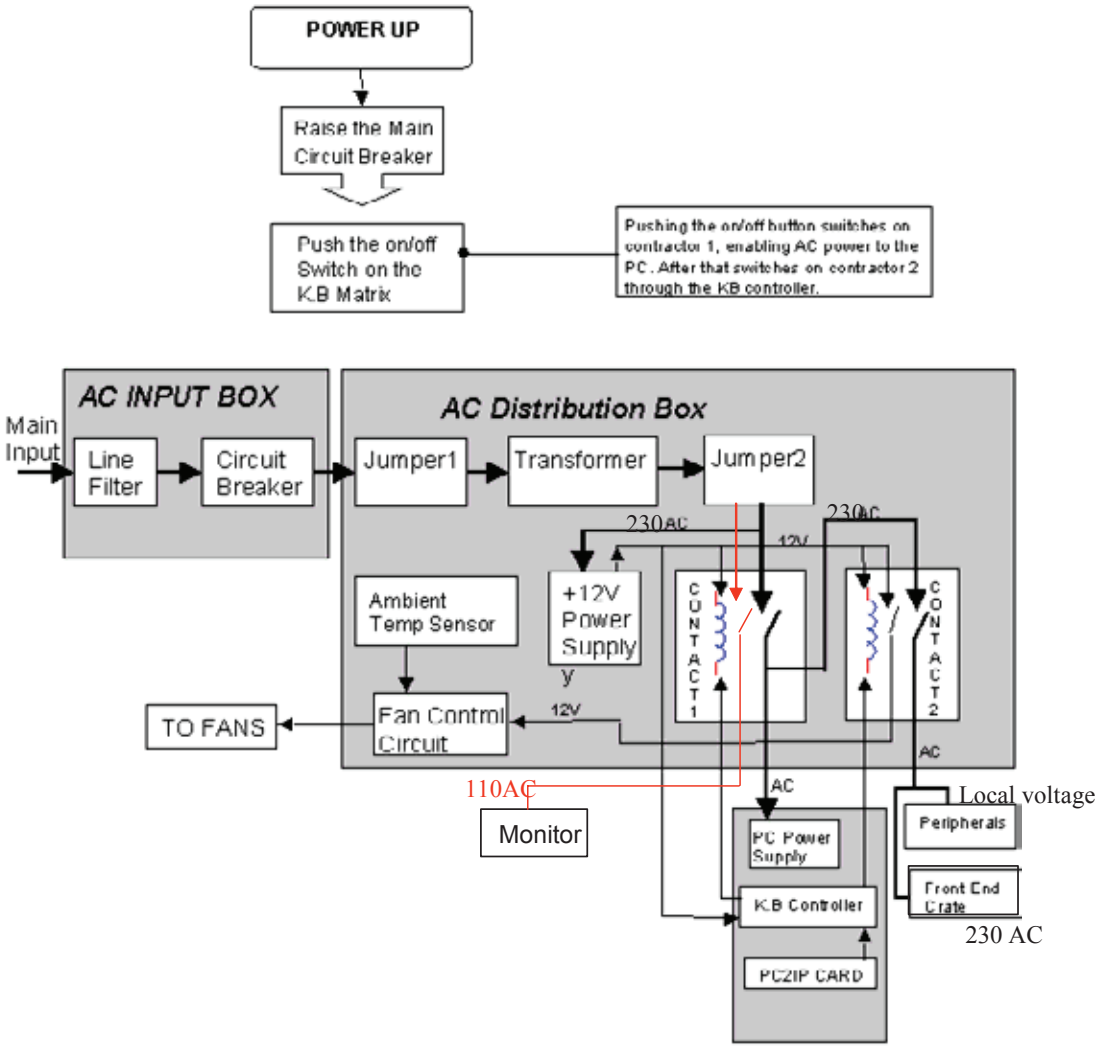

Figure 5-29 AC System Block Diagram - RFI Configuration

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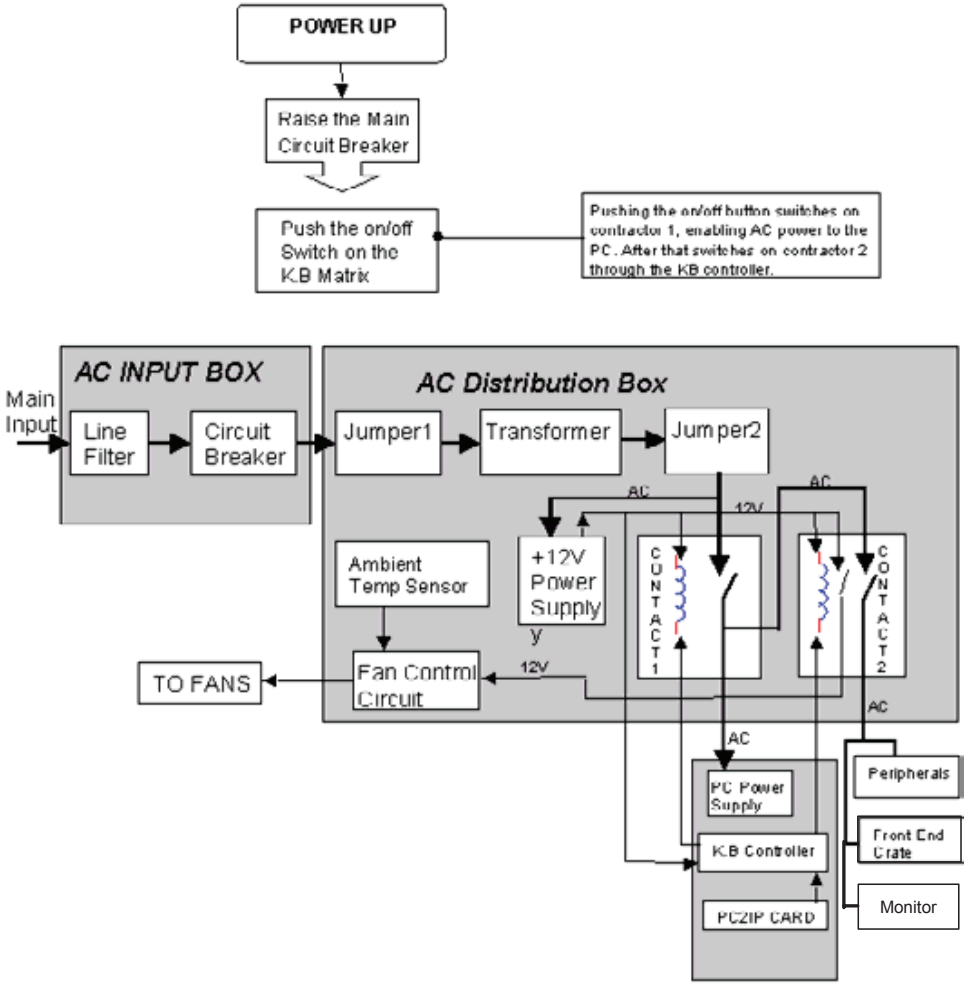

Figure 5-30 AC System Block Diagram - RFT Configuration

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5-7-3 AC Distribution Box

The AC Distribution Box contains an electronic board that selects the proper Input and Output system AC voltages, the load connectors, and the low voltage 12 V power supply. In addition, the AC Distribution Box controls the soft AC Start Circuit, the temperature sensor and the Fan Control Circuit.

Note: The cable to the fans also carries a playback video signal from the VCR to the Image Port.

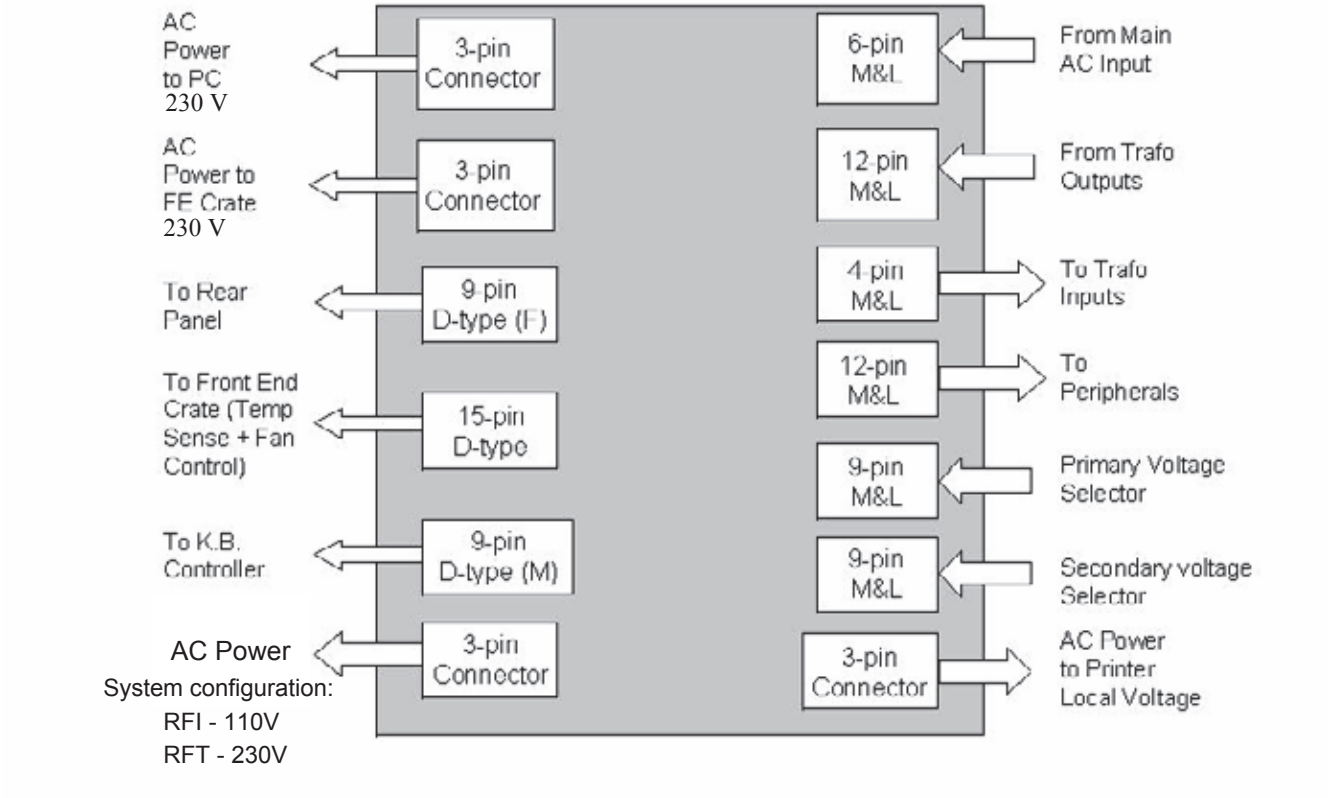

Figure 5-31 AC Distribution Box Connectors Block Diagram

5-7-3-1 AC Input Box

The AC Voltage Input cord is connected to the AC Input Box. It contains the Dual Rating Circuit Breaker 6A - 200 - 240V or 12A 100 - 120V.

5-7-3-2 Thermal Fuses

The system has three internal AC thermal fuses. One is connected to the secondary coil of the transformer, and supplies 230V to the system. The other two fuses are connected to the two coils that supply the local voltages (100V,120V, 220V-230V or 230V-240V). The coils are connected in parallel to the local voltage configuration.

The thermal fuses are located on the left rear panel.

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5-7-3-3 Input AC Voltage Configuration

- The Internal Vivid™ 3 voltage is 220 V AC.
- Back End and Front End Crates operate on 220 V AC.
- The Monitor and Peripherals operate on local voltage.
-

The AC input voltage is factory preset in accordance with specific requirements, as indicated on the label near the AC input connector. The AC transformer's primary and secondary voltages are set up by using the appropriate plugs connected in Jumper1 and Jumper2 on the AC Distribution Box, according to the following table:

Table 5-10 Primary and Secondary AC Voltage

Jumper 1 PRIMARY	**Voltage Range**	100-120V	220-240V		
	Plug P/N	2253054	2253056		
Jumper 2 SECONDARY	**Voltage**	100V	120V	220-230V	220-240V
	Plug P/N	2253057	2253058	2253059-2	2253060-2

NOTE: The AC input voltage power cord and its plug must meet the local standard requirements.

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5-7-4 Front End DC Power Distribution

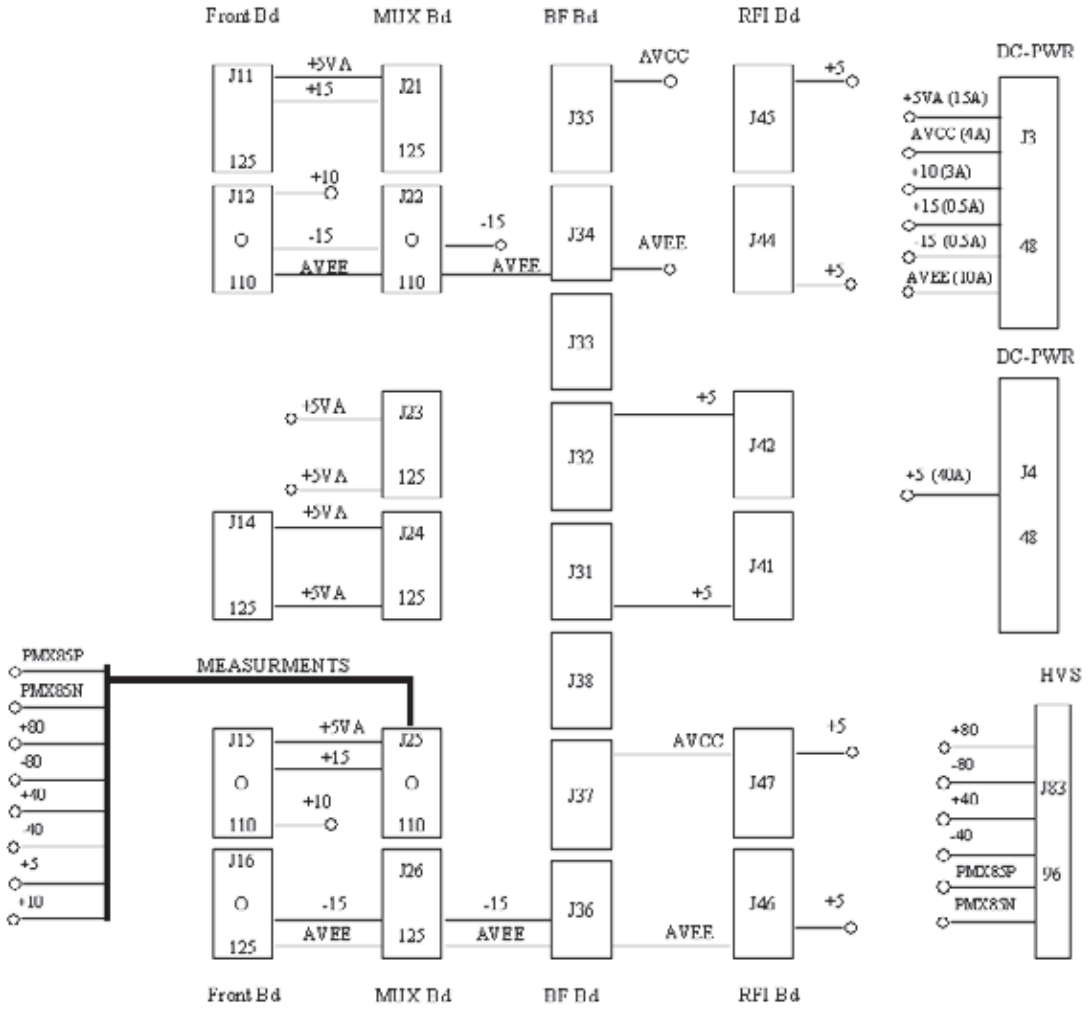

Figure 5-32 DC Distribution: Front End Crate (Vivid™ 4 Systems with RFI Configuration)

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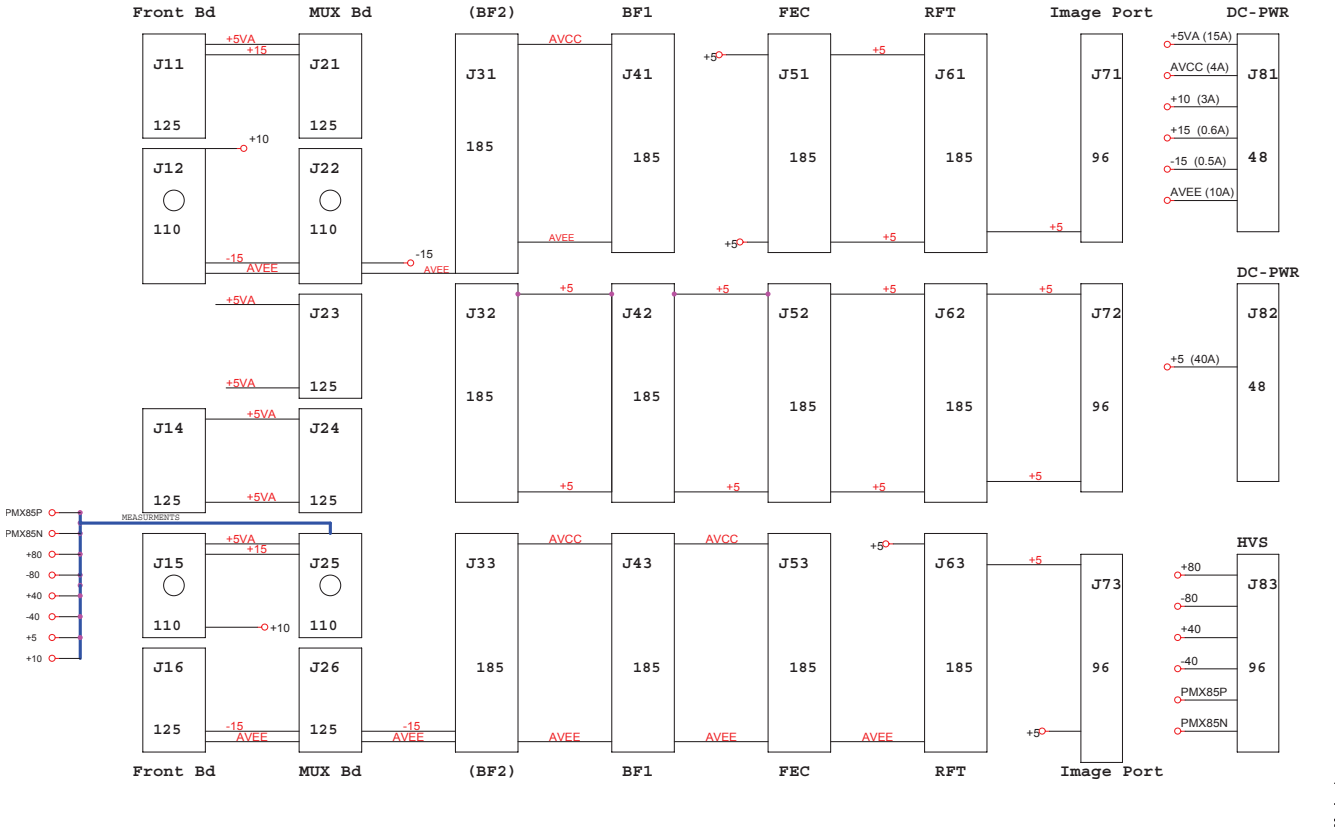

Figure 5-33 DC Distribution: Front End Crate (Systems with RFT Configuration)

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Section 5-8
Front End Cooling System

5-8-1 General Description

The Vivid™ 3 Front End cooling system includes following components:

- Dust Filter
- Fans

Other components that have an influence on the airflow is the Front End itself. Air is sucked from the inside of the system through the Filter Cover and the Filter. It passes the Fan Assembly, directly into the upper part of the Front End where it forms a cooling air current between the Boards, before being blown out against the floor. See Figure 5-34.

5-8-2 Location in the Unit

The Fan Assembly is located on top of the Front End Crate.

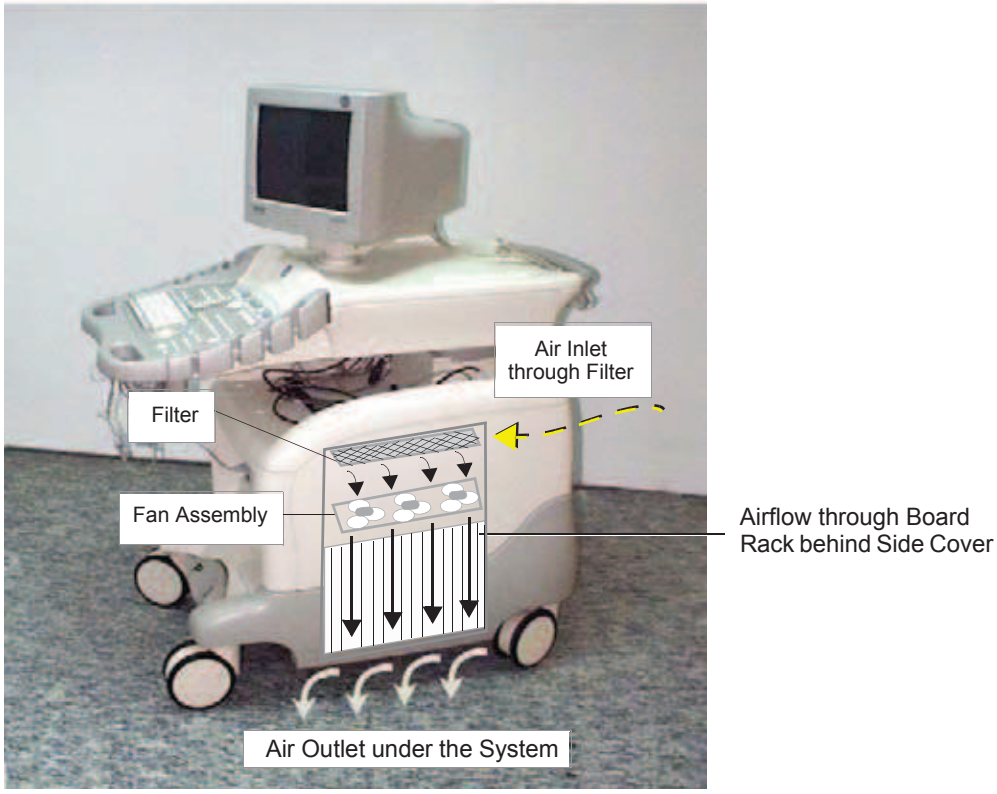

Figure 5-34 Airflow through the Vivid™ 3 System

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Section 5-9
Common Service Platform

5-9-1 Introduction

The Service Platform contains a set of software modules that are common to many of GE's ultrasound and cardiology systems. This web-enabled technology provides linkage to e-Services, e-Commerce, and the iCenter, making GE's scanners more e-enabled than ever.

5-9-2 *iLinq* Interactive Platform Features

Many of the services of the Common Service Platform come from its integration with *iLinq*. The following sections contain a brief introduction of *iLinq's* features.

5-9-2-1 Web Server/Browser

The Service platform and other Service software use the *iLinq* web server and browser.

5-9-2-2 Connectivity

This feature provides basic connectivity between the scanner and the OnLine Center (OLC).

5-9-2-3 Configuration

This feature provides the interfaces to configure various *iLinq* parameters.

5-9-2-4 Contact GE

Allows a one-switch touch for the user to contact the OnLine Center and describe problems with their scanner in an easy and convenient way.

5-9-2-5 Interactive Application

The main application is displayed in the form of HTML pages whenever the browser starts. This is the entry point for any user to start any *iLinq* application.

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5-9-3 Global Service User Interface (GSUI)

GSUI is the pattern for the user interface. This interface standard will be followed by all modalities to achieve a common look-and-feel for service software across all GEMS products.

5-9-3-1 Internationalization

The user interfaces provided by the service platform are designed for GE personnel and, as such, are in English only. At this time, there is no multi-lingual capability built into the Common Service Interface.

5-9-3-2 Service Login

Press the switch with the wrench icon ( ) in the status bar at the bottom of the video screen.

This switch links the user or the Field Engineer (FE) to the service login screen.

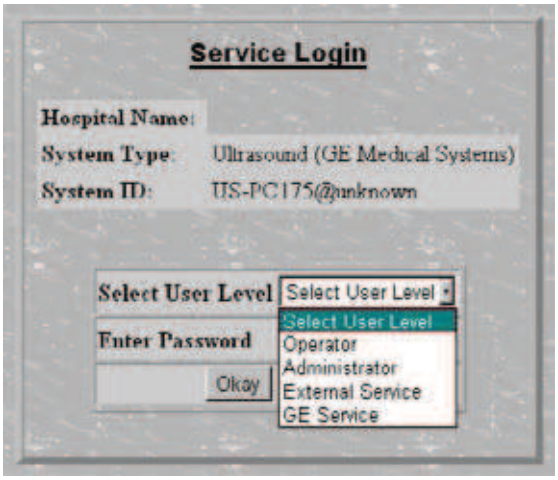

Figure 5-35 Service Login Screen

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5-9-3-3 Access / Security

The service interface has different access and security user levels. Users are only granted access to the tools they are authorized to use.

Table 5-11 Access Authorization

User Level	Access Authorization
Operator	These service tools are normally used in-house and are protected with a password.
Administrator	Use the OnLine Center access method provided by *iLinq*.
External Service	Access is protected with a password.
GE Service	Requires knowledge of a password.

A modem on the scanner is specifically intended for *iLinq* use (by the user) and for InSite use.

Every access request, whether successful or not, will be logged into a service access log that is viewable to authorized users.

See *Chapter 7 - Diagnostics/Troubleshooting* for more info about InSite and the Global Service User Interface.

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Chapter 6
Service Adjustments

Section 6-1
Overview

6-1-1 Purpose of Chapter 6

Table 6-1 Contents in Chapter 6

Section	Description	Page Number
6-1	Overview	6-1
6-2	Input AC Voltage Configuration	6-2
6-3	Front End Voltages and Signal Indicators	6-3
6-4	Back End Power Supply Voltages	6-8
6-5	VIC Video Signal Setting	6-8
6-6	Monitor Operation	6-9
6-7	Image Quality Calibration	6-12
6-8	Calibration	6-14

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Section 6-2
Input AC Voltage Configuration

- The internal Vivid™ 3 voltage is 220V AC.
- The Back End and Front End Crates operate on 220V AC.
- The Monitor and Peripherals operate on local voltage.

6-2-1 Secondary Voltage Configuration

The AC input voltage is factory preset according to specific requirements, as indicated on the label near the AC input connector. The AC transformer's primary and secondary voltages are set up by using the appropriate plugs connected in Jumper1 and Jumper2 on the AC Distribution Box, in accordance with the information in Table 6-2 below:

Table 6-2 Primary and Secondary AC Voltages

Jumper 1 PRIMARY	**Voltage Range**	100-120V	220-240V		
	Plug P/N	2253054	2253056		
Jumper 2 SECONDARY	**Voltage**	100V	120V	220-230V	230-240V
	Plug P/N	2253057	2253058	2253059-2	2253060-2

6-2-2 AC Input Cord

The input voltage power cord and plug must meet the local standards and requirements.

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Section 6-3
Front End Voltages and Signal Indicators

The majority of the boards in the Front End Crate have red, green and yellow LEDs, which indicate the board's status as follows:

- **Red LED Lit:** An error has occurred on the board (unless otherwise specified).
- **Yellow LED Lit:** Software defined.
- **Green LED Lit:** The board is functioning properly.

For RFI-configured systems, see Figure 6-1 below. Refer to Figure 6-2 on page 6-4 for systems with the RFT hardware configuration.

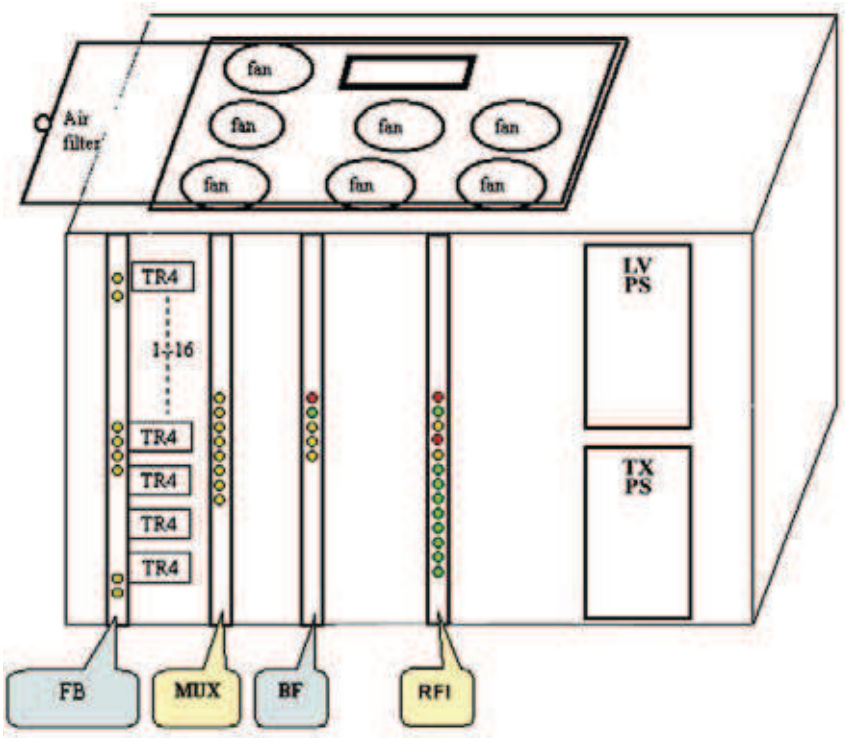

Figure 6-1 Front End Crate LEDs - RFI Configuration

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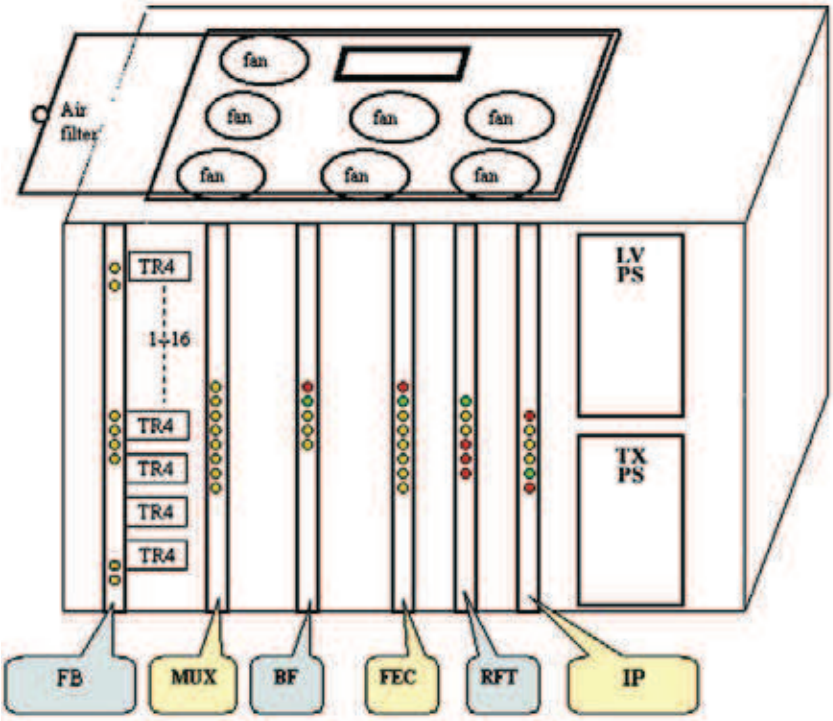

Figure 6-2 Front End Crate LEDs - RFT Configuration

The LEDs for each of the boards in the Front End Crate are summarized in the following subsections. The LEDs are listed as viewed from the top of the board, when positioned in the Front End Crate.

Note: The front end voltages can be measured at the front of the Front Board (FB) using the voltage test points.

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6-3-1 RFI LEDs

Table 6-3 RFI - LEDs

LED #	LED Color	Description	Normal State
LD505	- Red	Demod Error	
LD504	- Green	Lit in Scanning Mode	Slow tick in idle
LD503	- Yellow	Transmit data to BEP	During Processing
LD502	- Red	Not Used	
LD501	- Yellow	Not Used	
LD500	- Green	Not Used	
LD12	- Green	5.0 V status	
LD22	- Green	-2.0 V status	
LD11	- Green	1.4 V status	
LD10	- Green	1.5 V status	
LD9	- Green	3.3 V status	
LD8	- Green	-5.0 V status	
LD7	- Green	2.5 V status	

6-3-2 Image Port (IMP) LEDs

Table 6-4 Image Port LEDs

LED	Indicates When Lit	Comments
Red	Board Failure	Normally ON
Yellow		
Yellow	VME Master	Lit during scanning and data transfer
Yellow	VME Slave	
Green	Board OK	Normally lit
Red	Board Failure	Normally OFF

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6-3-3 Front End Controller (FEC) LEDs

Table 6-5 Front End Controller LEDs

LED	Indicates When Lit	Comments
Red	Board Failure	Normally OFF
Green	Board OK	Normally lit
Yellow	Scan	Lit during scanning
Yellow	Probe Change	Lit during probe change
Yellow	No Probe	Lit if no probe is selected
Yellow	HV Over Range	Lit if excessive HV is output, possibly due to HV surveillance

6-3-4 RF and Tissue Processor (RFT)

Table 6-6 RF and Tissue Processor LEDs

LED	Indicates When Lit	Comments
Red	Board Failure	Normally OFF
Green	Board OK	Normally lit
Yellow	DSP Runs	Normally blinking
Yellow	Data Out on Pipeline	Lit during data transfer to pipelink
Red	Clock Problems	Normally OFF
Red	Clock Problems	Normally OFF
Red	Clock Problems	Normally OFF

6-3-5 Beamformer (BF)

Table 6-7 Beamformer LEDs

LED	Indicates When Lit	Comments
Red	Board Failure	Normally OFF
Green	Board OK	Normally lit
Yellow	Bus Protocol Error	Normally OFF
Yellow	Scan	Normally OFF
Yellow		

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6-3-6 Channels Multiplexer (MUX)

Table 6-8 Channels Multiplexer LEDs

LED	Indicates When Lit	Comments
Green	5V PS is OK	Normally lit
Green	5V PS is OK	Normally lit
Green	5V PS is OK	Normally lit
Green	5V PS is OK	Normally lit
Green	5V PS is OK	Normally lit

6-3-7 Front Board Assembly (FB)

Table 6-9 Front Board Assembly LEDs

LED	Indicates When Lit	Comments
Green	15V LVPS is OK	Normally lit
Green	+15V LVPS is OK	Normally lit
Green	AVee LVPS is OK	Normally lit
Green	AVcc LVPS is OK	Normally lit
Green	+5V Dig LVPS is OK	Normally lit
Green	+10V LVPS is OK	Normally lit
T1	Probe Connector 1	Normally lit
T2	Probe Connector 2	Normally lit
T3	N/A	Normally lit
Green	+15RV LVPS is OK	Normally lit
Green	-15RV LVPS is OK	Normally lit
Green	AVee LVPS is OK	Normally lit
Green	AVcc LVPS is OK	Normally lit

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Section 6-4
Back End Power Supply Voltages

The Back End has LEDs located on the Mother Board that can indicate the status of each of the voltages present in the Back End. If measured with a generic digital volt meter on any of the connectors to the media (see Figure 6-3 below), the voltage on the red wire should be 5V, and on the yellow wire +12V.

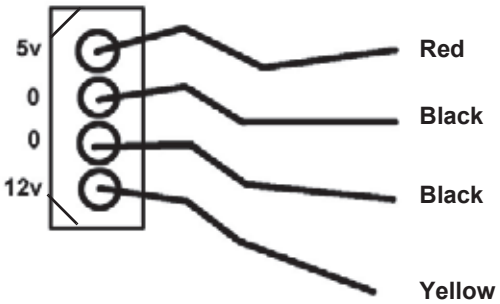

Figure 6-3 Back End Power Supply Voltages

Section 6-5
VIC Video Signal Setting

The Vivid™ 3 ultrasound scanner and VIC may be configured to operate with either PAL or NTSC video systems, as required.

6-5-1 Video Format Confirmation

1) Turn ON the system and the check video transmission signal is set correctly.
2) Press **Config**.
3) From the System Configuration dialog box, select the **VCR/ECG** tab and make sure Either **PAL** or **NTSC** is selected.
4) Click the **Technical Support** tab and make sure Frequency is set to either **60Hz** for NTSC, or **50Hz** for PAL.
5) Click **OK**.

Note: If the video format is not set correctly, contact an authorized GE Service Representative.

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Section 6-6
Monitor Operation

The monitor settings that can be adjusted for the Vivid™ 3 ultrasound unit can be split into two main types:

- **Geometry:** For example, *image size*, *position*, *linearity* and so on. The geometry calibration is usually performed once, and rarely requires additional recalibration.
- **Image Quality:** For example, *brightness*, *contrast* and *color balance*, as described in the *Image Quality Calibration* section, page 6-12.

6-6-1 Vivid™ 3 Samsung 15" and 17" Monitor Operation

NOTE: The information in this section relates to the new-type Samsung monitors, as follows:

- Samsung 15" Monitor (SyncMaster 591S; P/N 2336022-2)
- Samsung 17" Monitor (SyncMaster 795MB; P/N 2336835-6)

Most of the adjustments you make to your monitor will be accessed through the on-screen menu described in the next section. The Contrast and Brightness features can also be accessed directly from the front of your monitor, as described in the *Image Quality Calibration for the Vivid™ 3 15" and 17" Samsung Monitors* section, page 6-12.

6-6-1-1 On-Screen Menu System

Your monitor has an on-screen menu system, accessed by the buttons on the side of the monitor, that allows you to adjust characteristics of the screen image. Display changes are indicated by on-screen adjustment icons. Some functions have sub-menus.

Figure 6-4 Samsung 15" and 17" Monitor - On-Screen Menu System

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Table 6-10 15" and 17" On-Screen Menu Controls and Functions

Legend	Control	Function
1	Menu Button	Opens the On-screen menu. Also used to exit the menu, or return to the previous menu.
2	Adjust Button	Used to highlight and adjust items in the menu.
3	Enter Button	Used to select the On-screen menu.
4	Power Button	Used to turn ON/OFF power to the monitor.
5	Power Indicator	Light glows green during normal operation. Light blinks once as the monitor saves your adjustments.

NOTE: For clarification, the numbers appearing in square brackets in the following steps correspond to the numbers shown in Figure 6-4 and Table 6-10, above.

1) Push the menu button [**1**] to display the main menu and activate sub menus.
2) Push the adjustment button [**2**] to move through the icons and highlight items in the menu.The name of the function will appear on each window.
3) Push the menu button [**1**] to exit and save your changes.

6-6-1-2 15" and 17" Monitor Function Control Options

Table 6-11 Vivid™ 3 15" and 17" Monitor Controls and Functions

Control	Function
	Adjusts the background **Brightness** (white level) of the screen.
	Adjusts the **Contrast** level (black level) of the screen.
	A '**Moire**' pattern can appear on your screen, looking like a series of concentric circles or arcs. To eliminate this pattern, use the **horizontal** moire adjustments.
	A '**Moire**' pattern can appear on your screen, looking like a series of concentric circles or arcs. To eliminate this pattern, use the **vertical** moire adjustments.
	The **Degauss** feature will remove color impurities caused by magnetic fields. Do not use the Degauss feature more than once within a 30-minute period. Note: The monitor may buzz momentarily, the image colors may change and the image will jiggle for a few seconds. These effects are normal.
	Use the **Recall** feature to reset these monitor settings to their original levels: Position, Size, Pincushion, Trapezoid, Parallelogram, Pinbalance, Rotation, Clear Moire. Note: If you have selected "Yes", all settings listed above will be reset. All other settings will remain the same.
	Color temperature is a measure of the 'warmth' of the image colors. The available range is between 5000 to 9300K.

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Table 6-11 Vivid™ 3 15" and 17" Monitor Controls and Functions

Control	Function
	Adjust the monitor color setting (Red).
	Adjust the monitor color setting (Green).
	Adjust the monitor color setting (Blue).
	When you adjust the Brightness and Contrast after sRGB mode is selected, sRGB mode exits
	Follow these instructions to adjust the horizontal position of the monitor's entire display.
	Follow these instructions to adjust the vertical position of the monitor's entire display.
	Follow these instructions to adjust the horizontal size of the monitor's entire display.
	Follow these instructions to adjust the vertical size of the monitor's entire display.
	Adjust the pincushion setting when the sides of the display are bowed in or bowed out.
	Adjust the pinbalance setting when the sides of the display are bowed towards the left or right.
	Adjust the trapezoid setting when the top or bottom of the display is too large or small.
	Adjust the parallelogram setting when the display is leaning left or right.
	Adjust the rotation setting when the entire display is tilted left or right.
	Adjust the side pin corner correction when the top or bottom of the display is too large or small.

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Section 6-7
Image Quality Calibration

The monitor's image quality settings may need periodic adjustment due to changes in ambient light. They can be adjusted using the **Contrast** and **Brightness** buttons on the front (or side) of the display monitor. As the image quality settings are often adjusted, it is recommended to check - and if necessary recalibrate - these settings on a regular basis.

Note: When the monitor is too dark, and the user attempts to compensate by raising the total gain higher than normal, the resulting image quality may not be optimal.

All display monitor controls, other than the contrast and brightness controls, are factory adjusted for optimum settings and usually do not require further adjustment. The service representative adjusts the display monitor to the user's preference. To adjust controls independently, see the appropriate section below.

6-7-1 Image Quality Calibration for the Vivid™ 3 15" and 17" Samsung Monitors

NOTE: The information in this section relates to the new-type Samsung monitors, as follows:

- Samsung 15" Monitor (SyncMaster 591S; P/N 2336022-2)
- Samsung 17" Monitor (SyncMaster 795MB; P/N 2336835-6)

This section describes how to calibrate image quality related settings for the new-type 15" and 17" monitor on Vivid™ 3 ultrasound systems configured with software version 2.0, or above. The information complements the basic monitor adjustment instructions described in the *Vivid 3 Pro/Vivid 3 Expert User's Manual* 2300163-100 Rev. 0, pages 2-27 and 2-28.

Note: When the system is first switched on, the image may appear to be too dark, or to have too much contrast. The display monitor takes 20 minutes to warm up before it shows its final contrast, brightness, and color hues. Perform screen calibration only after the display monitor has warmed up.

1.) With the display monitor menu turned ON, press the button (to adjust contrast) or the button (to adjust brightness) on the side of the monitor.

2.) Press the arrows button on the side of the monitor to *decrease* or *increase* the selected value (refer to Figure 6-4 on page 6-9).

These recommended settings are stable and do not drift over time, but may vary from monitor to monitor. Adjust these recommended values to meet your specific requirements. For example, cardiac users may prefer greater contrast, in which case set the contrast to 90 or even 100. Radiologists may prefer less contrast, in which case set the contrast to below 80.

Table 6-13 Vivid™ 3 15"and 17" Monitors - Brightness and Contrast Settings

	15" Monitor (in Dark Room)	17" Monitor (in Dark Room)
Brightness	50	50
Contrast	100	80
Red	90	100
Green	90	100
Blue	100	100

Note: If after adjustment brightness is set below 10 or above 90, the monitor should be rejected.

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Note: Always perform the calibration in similar lighting conditions to those where the unit will be used. If the unit is to be used in different lighting conditions, perform full calibration in both dark and light conditions. It is suggested that you write down the brightness and contrast settings for both conditions, so that the monitor can be reset to the calibrated values.

3.) Press the Exit button twice to close the on-screen menu. The scanning screen is displayed.

4.) Perform monitor calibration as described in the Monitor Calibration on page 6 - 16.

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Section 6-8
Calibration

The *Diagnostic* dialog box (accessed by pressing **<Ctrl+F11>** or **<Alt+D>**, when in regular scanning mode), enables you to perform three types of calibration, as described in the following sections:

- *Monitor Calibration* section, page 6-16.
- *Beamformer Calibration* section, page 6-17.
- *Video Grabbing Calibration* section, page 6-17.

6-8-1 Accessing the Calibration Options

1) Press **<Ctrl+F11>** (or **<Alt+D>**) on the alphanumeric keyboard. The *Diagnostic* dialog box is displayed, as shown below:

Figure 6-5 Diagnostic Dialog Box

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2) Trackball to the **Calibration** button and press **Select**. The following calibration options are displayed:

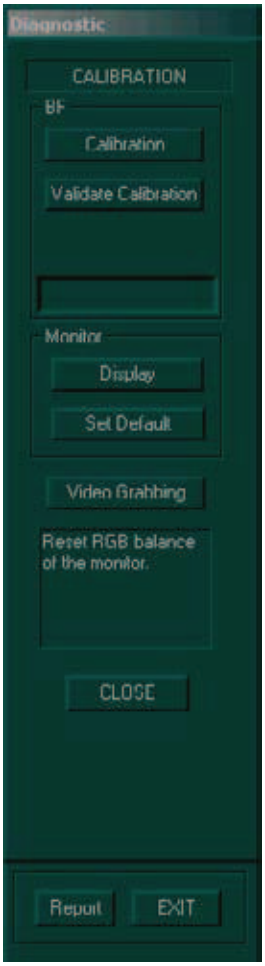

Figure 6-6 Calibration Options

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6-8-2 Monitor Calibration

Monitor calibration should be performed after adjusting the image quality settings using the monitor's control buttons, as described in the *Monitor Operation* section, page 6-9.

1) Access the calibration options, as described in the *Calibration* section, page 6-14.
2) Trackball to the **Display** option and press **Select**. The *Calibration Display* window is displayed, as shown below:

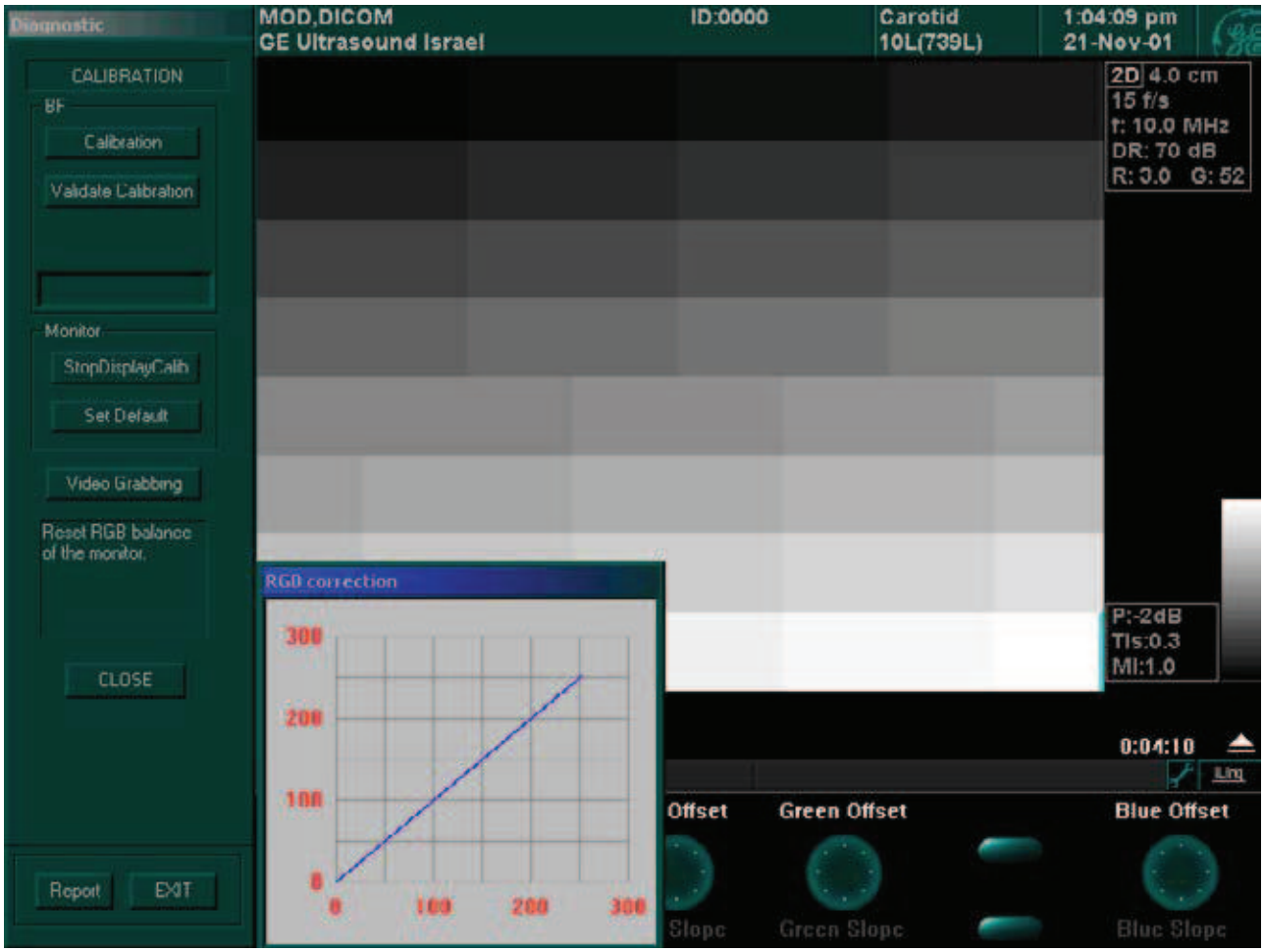

Figure 6-7 Calibration Display Window

3) Adjust the brightness of the monitor so that the black square in the upper-left corner of the window is as dark as possible, while a faint border remains visible between that square and the square to its right.
4) Rotate the soft key rotaries to offset the red, green and blue colors, to change the grey shades displayed. By default, the *RGB Calibration* window shows one line at 45 degrees (Blue).
5) Trackball to the **StopDisplayCalib** button and press select to complete the monitor calibration.

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6-8-3 Beamformer Calibration

NOTE: IMPORTANT - Do not perform BF Calibration after operating in CW or PW scanning modes since validation will fail. Perform the BF Calibration procedure only after 2D scanning mode.

Beamformer (BF) calibration is performed to calibrate each of the two BF input's ADC channels. The system calibrates the ADC to zero when there is no signal in the input. These bias voltages are stored in the back end. When changing the BFs, swapping the BFs, or changing the hard disk, perform the BF calibration procedure.

1) Access the calibration options, as described in the *Calibration* section, page 6-14.
2) Trackball to the **Calibration** button and press **Select**. The bias voltages for each channel are validated and stored in the back end.

Note: If necessary, Trackball to the **Validation** button and press **Select** to validate the currently saved bias voltages for each channel without performing calibration.

6-8-4 Video Grabbing Calibration

Video Grabbing calibration is performed when the system's Y/C Video Output is connected to the Y/C Video Input.

1) Access the calibration options, as described in the *Calibration* section, page 6-14.
2) Trackball to the **Video Grabbing** button and press **Select**. The *Video Grabbing* window is displayed, as shown below:

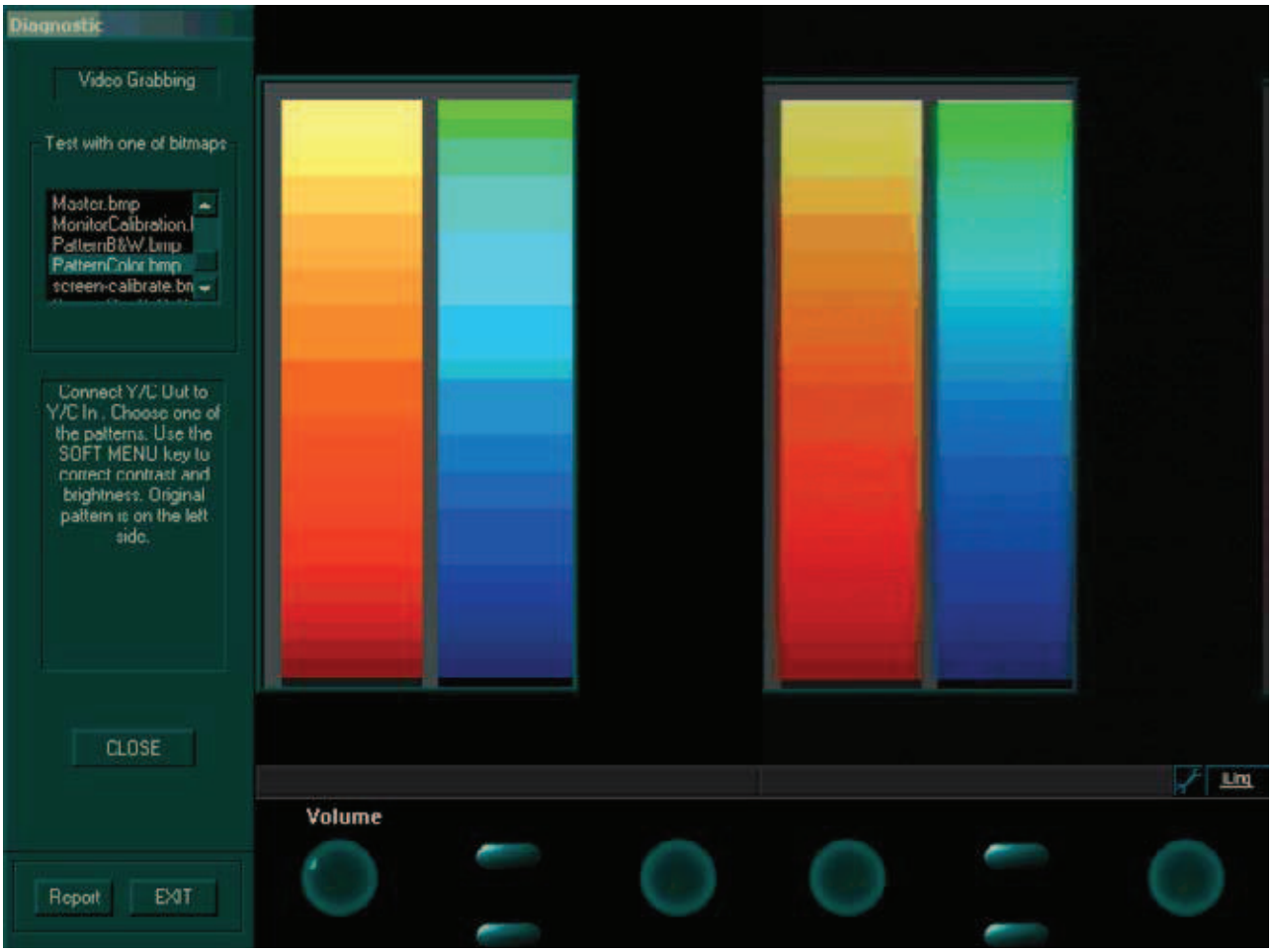

Figure 6-8 Video Grabbing Window

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3) Connect the Y/C cable from **Video OUT** to **Video IN** on the right rear panel.

4) Select the **PatternB&W.bmp** from the **Test with one of bitmaps** area. You will observe the duplication of the selected pattern. This selected pattern is generated by the system and grabbed by the IP card. Compare the two patterns on the screen and ensure that the right side has almost the same quality as the left side.

Note: The video signal path is from the Back-End SVGA board output to the VIC, via the rear panel connector, IP, and then back to the Back End, via the PC2IP cable.

5) Select the **PatternColor.bmp**, from the **Test with one of bitmaps** area. You will observe the duplication of the selected pattern. This selected pattern is generated by the system and grabbed by the IP card. Compare the two patterns on the screen and ensure that the right side has almost the same quality as the left side.

6) To complete the test, select bitmap **screen calibrate.bmp** and verify the correct image geometry.

7) Trackball to the **Close** button and press **Select**.

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Chapter 7
Diagnostics/Troubleshooting

Section 7-1
Overview

7-1-1 Purpose of Chapter

This chapter describes how to set up and run diagnostic tools to locate system problems and failures. The Vivid™ 3 ultrasound unit includes built-in diagnostic tools that can be accessed from the scanner application.

Table 7-1 Contents in Chapter 7

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Section 7-2
Diagnostics

7-2-1 Diagnostic Tools

The diagnostic tools check the system parts, as well as power supplies, temperature, fan operation, board functions, Back-end signal processing performance, keyboard operation, and so on.

7-2-2 Diagnostic Procedure Summary

The diagnostic tools are used to identify and correct problems as follows:

- When the system boots up, it loads all the required drivers and establishes communication with the front board, via the IP card. Check the system presets to verify that good unit performance can be achieved.
- When the Back End is operating, you can verify proper voltages and temperatures in the Front End motherboard and in the AC Distribution Box. To check the Front End parts, the tests must follow a logical sequence, in order to identify the faulty component. For example, testing communication between the Front End and the Back End begins by testing the RFI board (IMP board) and the PC2IP, before testing all the other boards, in the following sequence (as applicable):

  For systems with RFI configuration: *RFI board, BF board, FB and MUX board*

  OR

  For systems with RFT configuration: *VME Bus*, *FEC*, *RFT*, *BF board,* FB and *MUX board*.

- Many error messages are displayed due to minor changes in calibration that may occur during normal operation. Before performing diagnostic tests, perform calibration, as described in the *Calibration* section, page 6-14. If error messages are displayed after performing calibration, perform the Front End diagnostics described in Performing Front End (FE) Diagnostics on page 7 - 5.

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7-2-3 Accessing the Diagnostic Menu

The diagnostic tools are accessed from 2D-Mode by simultaneously pressing **<Ctrl+F11>** on the alphanumeric keyboard. The *Diagnostic* menu is displayed, as shown below:

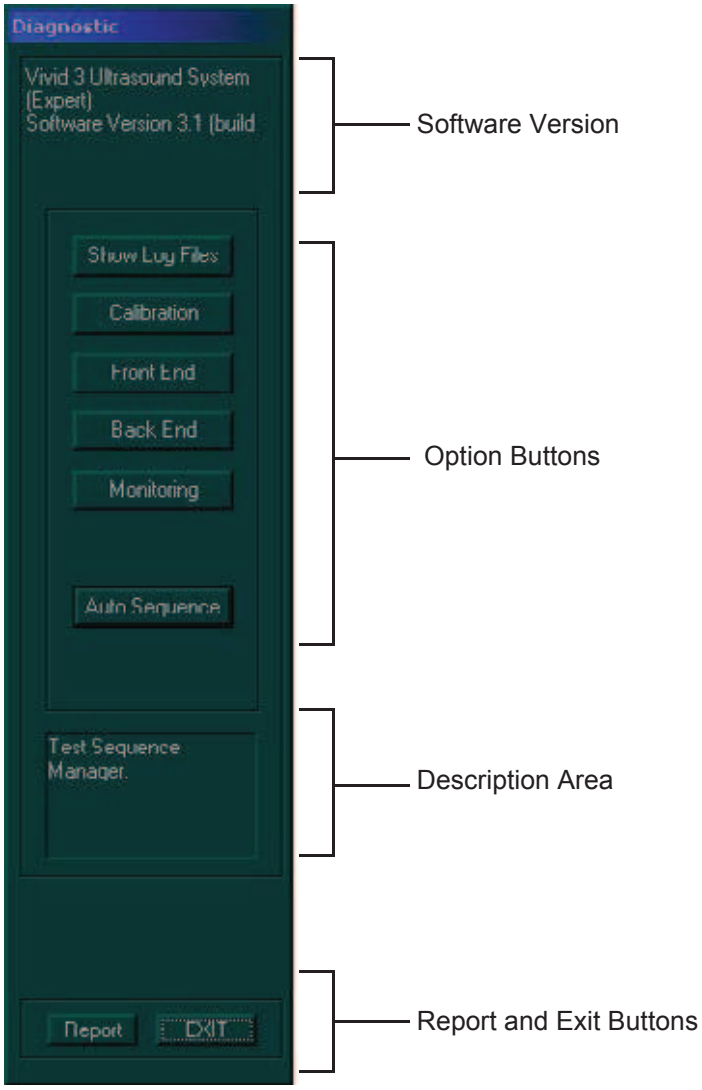

Figure 7-1 Diagnostic Menu

Note: Once the test has been completed, a log can be viewed, as described in the *Common Service Interface* section, on page 7-84.

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7-2-3-1 Diagnostic Menu Options

The *Diagnostic* menu includes the following options:

- **Software Version:** Displays the Vivid™ 3 ultrasound unit software version number and last upgrade date.
- Show Log Files **:** Displays test results, as described in the *Common Service Interface* section, on page 7-84.
- Calibration **:** Calibrates the Front End crate, and enables you to perform the display and video grabbing test, as described in Calibration on page 6 - 14.
- Front End **:** Tests each board in the Front End crate including the TR power supply, the LVPS supply and temperatures, as described in the *Performing Front End (FE) Diagnostics* section, on page 7-5.
- Back End **:** Tests various back end hardware components, as described in the *Performing Back End Diagnostics on the System* section, on page 7-68.
- Monitoring **:** Monitors all low voltages, Tx voltages, temperatures and AC power input.
- Auto Sequence **:** Performs a full sequence of Front End tests that do not require user intervention. Auto Sequence is particularly recommended for detecting problems that are intermittent in nature, since a test may be paused at any stage and any detected failures reviewed. This is described in the *Auto Sequence* section, on page 7-6.
- **Description Area:** Displays a description of the function performed when each of the buttons is selected. Trackball the cursor over a button to display a description in the **Description** area.
- **Report Button:** Displays a current diagnostics report.
- **Exit Button:** Closes the *Diagnostic* menu.

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Section 7-3
Performing Front End (FE) Diagnostics

When performing Front End Diagnostics tests, it is strongly recommended to start with **Auto Sequence**, especially if the system shows signs of an intermittent problem. As described in this section, the testing sequence can be paused and restarted at any stage, providing a quick and easy method of reviewing any detected faults.

*NOTE: When using Auto Sequence, most of the FE tests that can be performed manually (refer to the list numbered 1 through 8, below) are automatically performed, in sequence. However the following tests are **NOT** included in Auto Sequence. These should be performed manually, as described in the appropriate sections:*

- Front Board Assembly (FB) — Transmit Test; TR Switch Test; FLA Jumper Test; Pencil Probe Test
- MUX Board — Advanced Board Tests

NOTE: During Auto Sequence, the system will automatically re-boot at least twice. This is normal and should not give cause for concern.

The Front End diagnostic tests listed below can be initiated manually and performed by the system, as described in this section. For each type of system configuration (either RFI or RFT), it is recommended that these diagnostic tests be performed *in the following sequences* (as applicable)*:*

- For systems with **RFI CONFIGURATION**:
  1.) **RFI Diagnostic Test**, as described in the *Radio Frequency Interface (RFI) Diagnostic Tests (for RFI Configuration)* section, on page 7-11.
  2.) **Beamformer (BF) Diagnostic Test**, as described in the *Beamformer (BF) Diagnostic Tests* section, on page 7-21. At this stage, to continue to the Front End diagnostic tests, it is necessary to re-boot the system.
  3.) **Front Board Assembly (FB) Diagnostic Test**, as described in the *Front Board Assembly (FB) Diagnostic Tests* section, on page 7-25.
  4.) **MUX Diagnostic Test**, as described in the *MUX Diagnostic Tests* section, on page 7-47.
  5.) **H/W Report Diagnostic Test**, as described in the *H/W Report* section, on page 7-66.
- For systems with **RFT CONFIGURATION**:
  1.) **Image Port (IMP) Diagnostic Test**, as described in the *Image Port (IMP) Diagnostic Tests (for RFT Configuration)* section, on page 7-13.
  2.) **VME Bus (VME) Diagnostic Test**, as described in the *VME Bus (VME) Diagnostic Tests (for RFT Configuration)* section, on page 7-15.
  3.) **RFT Diagnostic Test**, as described in the *RFT Diagnostic Tests (for RFT Configuration)* section, on page 7-17.
  4.) **Front End Controller (FEC) Diagnostic Test**, as described in the *Front End Controller (FEC) Diagnostic Tests (for RFT Configuration)* section, on page 7-19.
  5.) **Beamformer (BF) Diagnostic Test**, as described in the *Beamformer (BF) Diagnostic Tests* section, on page 7-21. At this stage, to continue to the Front End diagnostic tests, it is necessary to re-boot the system.
  6.) **Front Board Assembly (FB) Diagnostic Test**, as described in the *Front Board Assembly (FB) Diagnostic Tests* section, on page 7-25.
  7.) **MUX Diagnostic Test**, as described in the *MUX Diagnostic Tests* section, on page 7-47.
  8.) **H/W Report Diagnostic Test**, as described in the *H/W Report* section, on page 7-66.

NOTE: If the system must be re-booted, do so. Continue testing from the point at which you were required to reboot. If a failure occurs, re-boot the system and test again to verify the outcome of the test.

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7-3-1 Accessing the Front End Diagnostic Options

- In 2D-Mode, press **<Ctrl+F11>** on the alphanumeric keyboard. The *Diagnostic* menu is displayed, as shown in Figure 7-1 on page 7-3.

NOTE: It is recommended to commence Front End Diagnostic tests using the Auto Sequence option, as described below. To perform tests using the manual options, see Manual Options on page 7 - 8.

7-3-1-1 Auto Sequence

1.) In the *Diagnostic* menu, trackball to the **Auto Sequence** button and press **Select**. The *Automatic FE Testing* dialog box is displayed, as shown below:

Figure 7-2 Automatic FE Testing

2.) Select the required number of *Loops* and activate the **Enable** checkbox.

3.) Under *On Failure,* activate either the **Stop** or **Continue** checkbox, as required. Stopping on failure enables you to review a failed test, the moment it fails. Alternatively, you may prefer testing to continue on failure and later you may review the report.

4.) Under *Execute Sequence,* trackball to the **Start** button and press **Select**.

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Auto Sequence commences. While the sequence of automatic testing proceeds, the name of the test currently in progress is displayed in the *Test Name* field and the current *Loop #* and *Step #* are shown below. In addition, a flashing colored light below the *Passed* and *Failed* displays, indicates the current test status, as follows:

- **Green** = test passed
- **Yellow** = test in progress
- **Red** = test failed

5.) At any stage, trackball to the **Pause** button (under *Execute Sequence)* and press **Select**, if required.

6.) To resume testing (from the point where you paused), trackball to the **Start** button and press **Select.**

7.) At any stage during the testing sequence, trackball to the **View Report** button and press **Select** to review the current Auto Sequence Test Report.

8.) When Auto Sequence is complete, trackball to the **View Report** button and press **Select** to review the final Auto Sequence Test Report. This will now list all tests performed and show details of which tests passed or failed.

9.) Trackball to the **Exit** button and press **Select** to close the *Automatic FE Testing* dialog box.

NOTE: During Auto Sequence, the system will automatically re-boot at least twice. This is normal and should not be cause for concern.

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7-3-1-2 Manual Options

1.) In the *Diagnostic* menu, trackball to the **Front End** button and press **Select**. The *FE Diagnostics* dialog box is displayed, as shown in Figure 7-3 (or Figure 7-4) below:

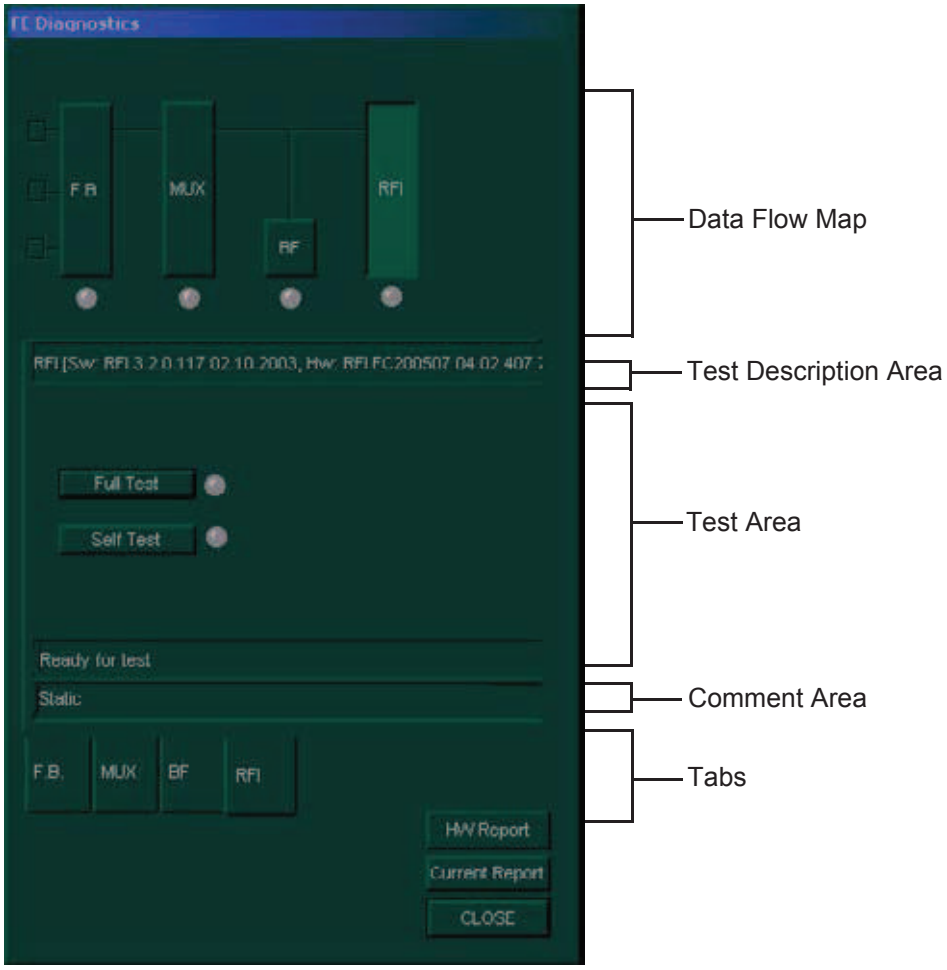

Figure 7-3 FE Diagnostics Dialog Box - RFI Configuration

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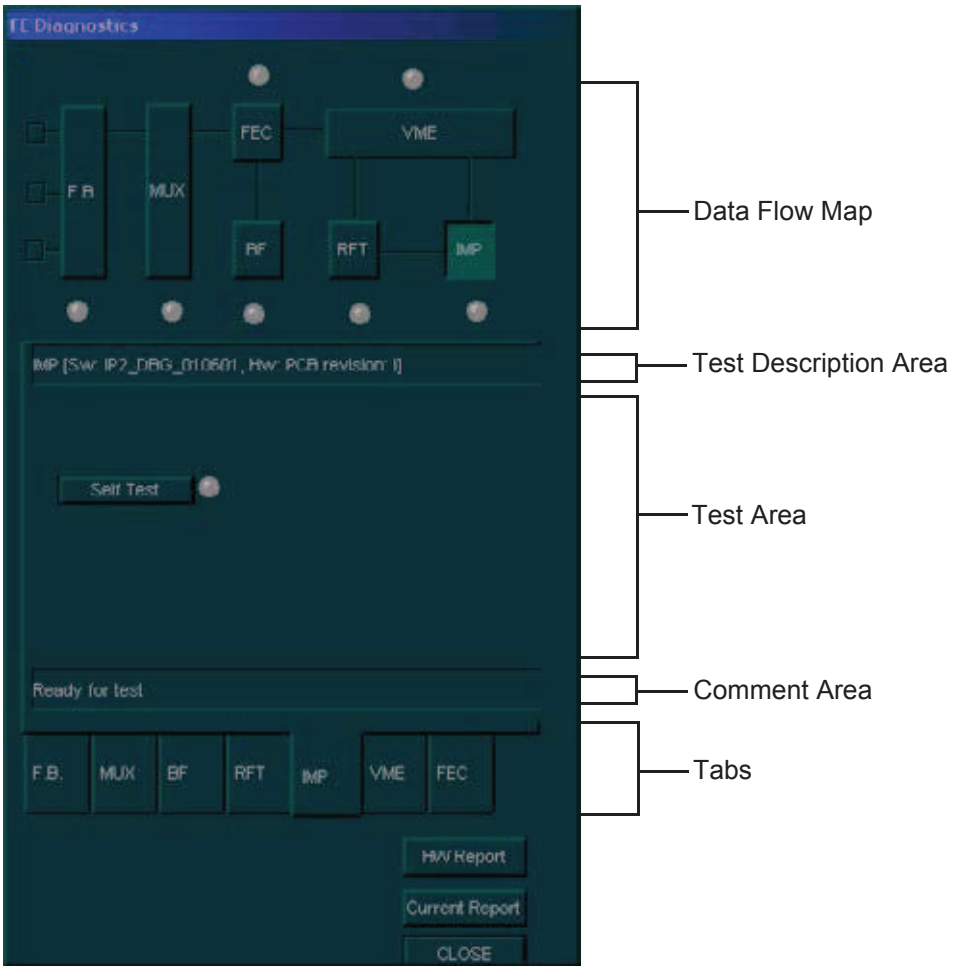

Figure 7-4 FE Diagnostics Dialog Box - RFT Configuration

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The *FE Diagnostics* dialog box includes the following options:

Table 7-2 FE Diagnostics Dialog Box Options

Option	Description	Comments
Data Flow Map	Displays a graphic representation of the Vivid™ 3 data flow. The functionality of each button in this area corresponds to that of the tab of the same name in the lower portion of the dialog box. Each button or tab enables you to select and perform the FE diagnostic tests by trackballing to the required button or tab and pressing **Select**.	Each button has an LED that indicates the following by its color: • **Green:** The test has been completed and no problems were identified. • **Red:** Problems were identified during the performance of the test. • **Yellow:** The test is in progress.
Test Description Area	Displays a description of the selected diagnostic test.	
Test Area	Displays the buttons that enable you to perform diagnostic tests.	Each button has an LED that indicates the following by its color: • **Green:** The test has been completed and no problems were identified. • **Red:** Problems were identified during the performance of the test. • **Yellow:** The test is in progress.
Comment Area	Displays instructions during the test, as well as test status and result messages.	The following messages are displayed: • **Test status:** For example, **Ready for test** or **Complete** • **Instructions:** During the course of a diagnostic test, any instructions to the user are displayed in the Comment area • **Test results:** For example, **Pass** or **Fail**.
Tabs	Enable you to select and perform the FE diagnostic tests.	
H/W Report Button	Displays hardware and software version information, as described in *Chapter 1 - Introduction*.	
Current Report Button	Displays the saved error log, as described in the *Common Service Interface* section, on page 7-84.	
Close Button	Closes the *FE Diagnostic* dialog box and re-displays the *Diagnostic* menu.	

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7-3-2 Radio Frequency Interface (RFI) Diagnostic Tests (for RFI Configuration)

1) Access the *FE Diagnostics* dialog box, as described in the *Accessing the Front End Diagnostic Options* section, on page 7-6.

2) In the *FE Diagnostics* dialog box, trackball to the **RFI** tab and press **Select**,

The **RFI** tab is displayed, as shown below:

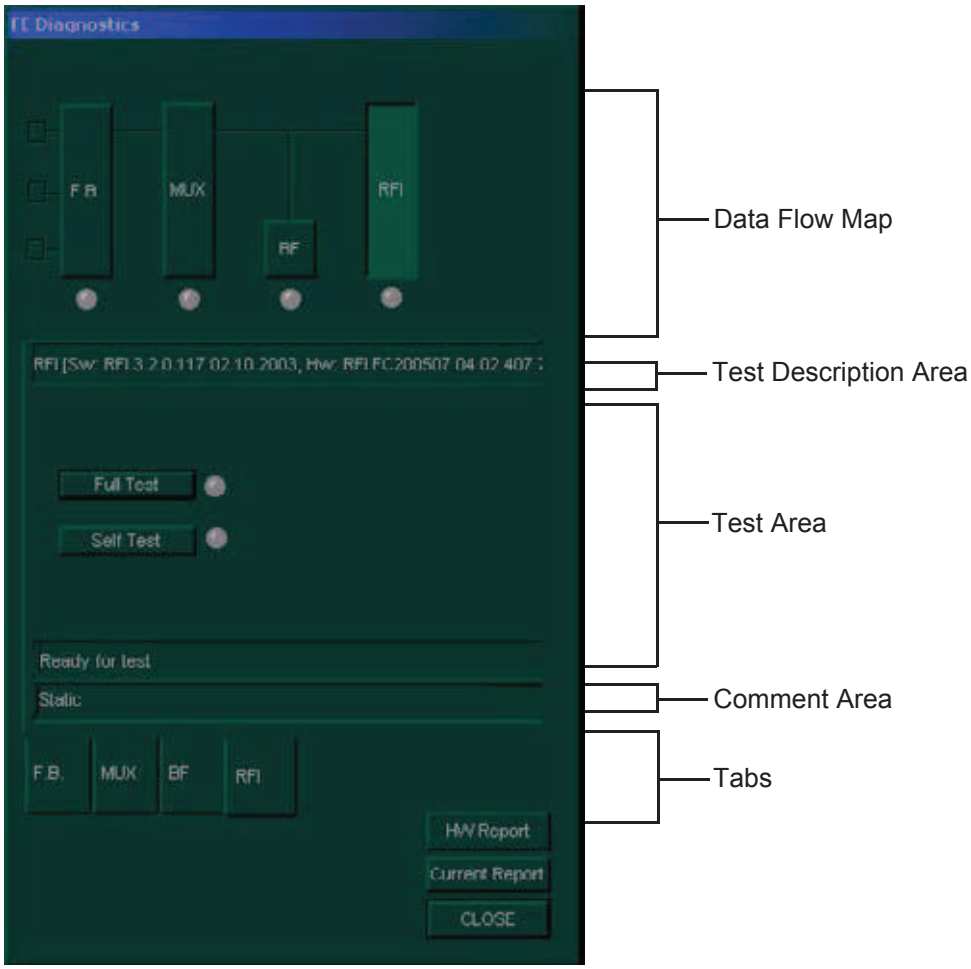

Figure 7-5 RFI Tab - FE Diagnostics Dialog Box

Note: Proper operation of the RFI board may be tested by performing either of the two tests: *Self Test* or *Full Test*, as required. (While the Full Test is in progress, it may be necessary to wait a while since this requires longer than the Self Test for completion).

3) Verify that the **Comment** area indicates that the system is ready to perform the test (as shown in Figure 7-5, above).

4) Trackball to the **Full Test** tab and press **Select**.

OR

Trackball to the **Self Test** tab and press **Select**.

The **Full Test** (or **Self Test**) LED changes color as follows:

- **Yellow:** The test is in progress.
- **Green:** The test has been completed and no problems were identified.
- **Red:** Problems were identified during the performance of the test.

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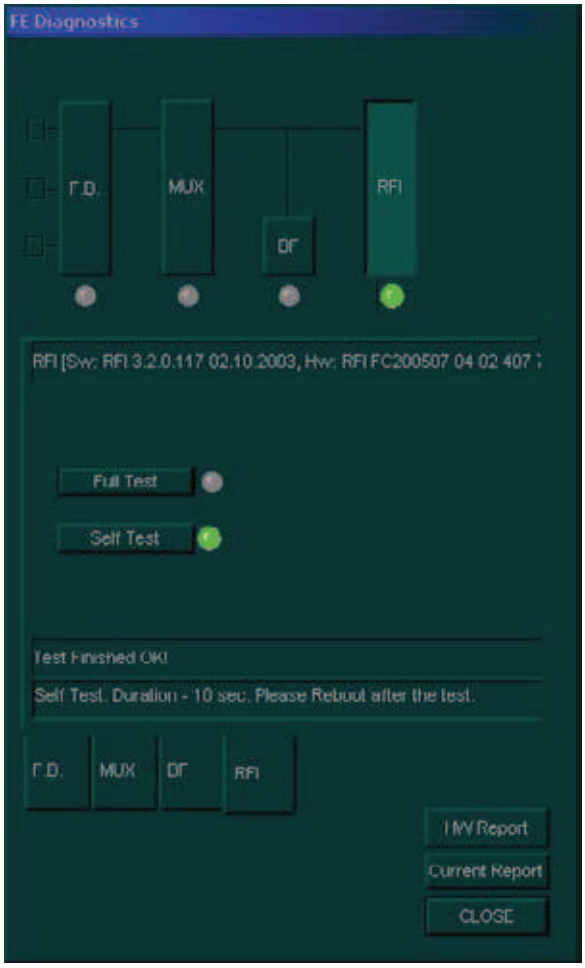

Figure 7-6 RFI Tab - Self Test Complete

5) Review the test results in the **Comment** area and proceed as follows:

- If no problems were identified, proceed to re-boot the system, as prompted (Figure 7-6, above).
- If no problems were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
- If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the RFI test.
- If errors were identified and the results were not marginal, verify that the RFI cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.

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7-3-3 Image Port (IMP) Diagnostic Tests (for RFT Configuration)

1) Access the *FE Diagnostics* dialog box, as described in the *Accessing the Front End Diagnostic Options* section, on page 7-6.

2) In the *FE Diagnostics* dialog box, trackball to the **IMP** tab and press **Select**,

   OR

   Trackball to the **IMP** button in the **Data Flow Map** and press **Select**.

   The **IMP** tab is displayed, as shown below:

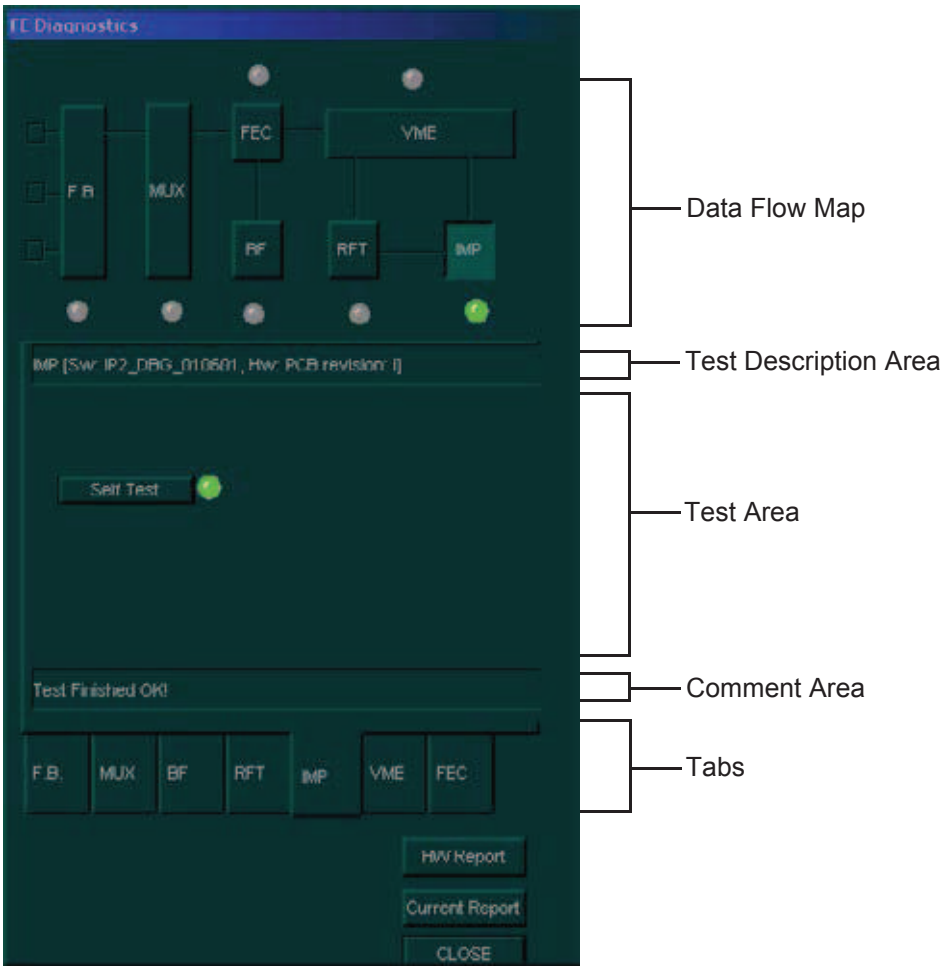

Figure 7-7 IMP Tab - FE Diagnostics Dialog Box

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3) In the **IMP** tab, verify that the **Comment** area indicates that the system is ready to perform the test.

4) Trackball to the **Self Test** button and press **Select** to check the performance of the IMP board. The **Self Test** LED changes color as follows:

   - **Yellow:** The test is in progress.
   - **Green:** The test has been completed and no problems were identified.
   - **Red:** Problems were identified during the performance of the test.

5) Review the test results in the **Comment** area and proceed as follows:

   - If no problems were identified, proceed to the VME test, as described in the *VME Bus (VME) Diagnostic Tests (for RFT Configuration)* section, on page 7-15.
   - If no problems were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
   - If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the IMP test.
   - If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory).* If the problem persists, contact your local GE Medical Systems field engineer for assistance.

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7-3-4 VME Bus (VME) Diagnostic Tests (for RFT Configuration)

The VME Bus diagnostic test checks the communication on the VME Bus between the IP card, the FEC and the RFT.

Note: Before performing the VME Bus test, perform the IMP test, as described in the *Image Port (IMP) Diagnostic Tests (for RFT Configuration)* section, on page 7-13. If the VME Bus test is performed without first performing this test, and errors are identified, you must perform the IMP test to ensure that the VME board is the source of the error.

1) Access the *FE Diagnostics* dialog box, as described in the *Accessing the Front End Diagnostic Options* section, on page 7-6.
2) In the *FE Diagnostics* dialog box, trackball to the **VME** tab and press **Select**,

   OR

   Trackball to the **VME** button in the **Data Flow Map** and press **Select**.

   The **VME** tab is displayed, as shown below:

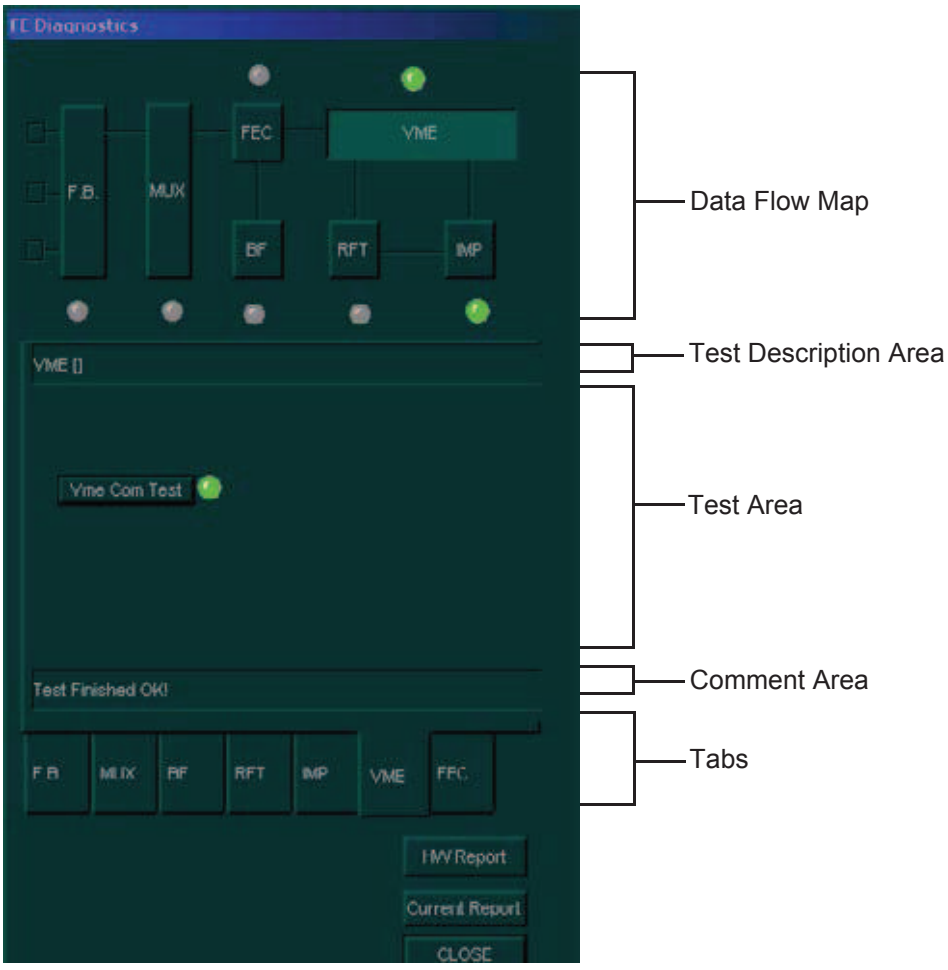

Figure 7-8 VME Tab - FE Diagnostics Dialog Box

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3) In the **VME** tab, verify that the **Comment** area indicates that the system is ready to perform the test.

4) Trackball to the **Vme Com Test** button and press **Select**. The **Vme Com Test** LED changes color as follows:

   - **Yellow:** The test is in progress.
   - **Green:** The test has been completed and no problems were identified.
   - **Red:** Problems were identified during the performance of the test.

5) Review the test results in the **Comment** area and proceed as follows:

   - If no problems were identified, proceed to the RFT test, as described in the *RFT Diagnostic Tests (for RFT Configuration)* section, on page 7-17.
   - If no problems were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
   - If errors were identified but the results were marginal, perform calibration, as described in Calibration on page 6 - 14, and then repeat the VME test.
   - If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.

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7-3-5 RFT Diagnostic Tests (for RFT Configuration)

The RFT diagnostic tests include the tests listed below:

- **Board Test:** General RFT board test which activates the remaining tests sequentially. Each of these tests can also be performed independently.
- **Self Test 1:** Short generic board test, generated in a local DSP.
- **Self Test 2:** High level board test, generated in a local DSP. Self Test 2 lasts six minutes.

Note: Before performing the RFT test, perform the IMP and VME Bus tests, as described in the *Image Port (IMP) Diagnostic Tests (for RFT Configuration)* section, on page 7-13 and in the *VME Bus (VME) Diagnostic Tests (for RFT Configuration)* section, on page 7-15. If the RFT test is performed without first performing these tests, and errors are identified, you must perform the VME Bus test, and then the IMP test, to ensure that the RFT board is the source of the error.

1) Access the *FE Diagnostics* dialog box, as described in the *Accessing the Front End Diagnostic Options* section, on page 7-6.
2) In the *FE Diagnostics* dialog box, trackball to the **RFT** tab and press **Select**,

   OR

   Trackball to the **RFT** button in the **Data Flow Map** and press **Select**.

   The **RFT** tab is displayed, as shown below:

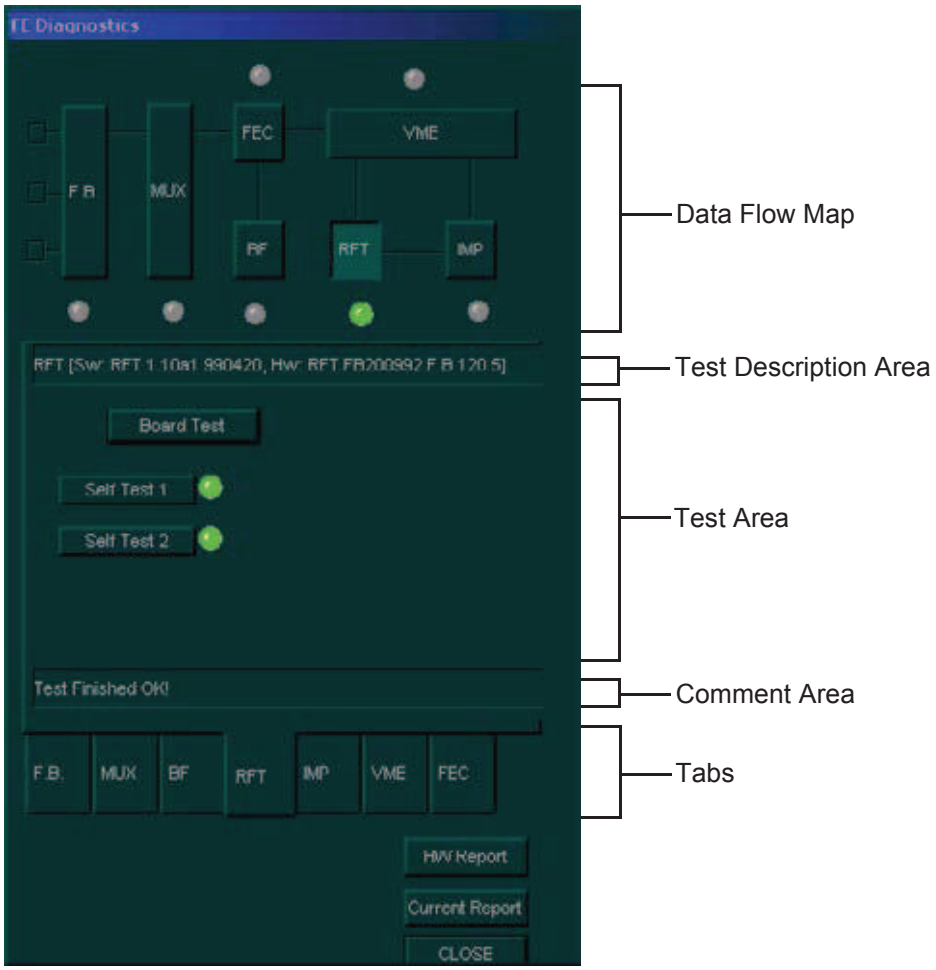

Figure 7-9 RFT Tab - FE Diagnostics Dialog Box

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3) In the **RFT** tab, verify that the **Comment** area indicates that the system is ready to perform the test.

4) Trackball to one of the following buttons and press **Select**:

   - Select the **Board Test** button to perform **Self Test 1** and **Self Test 2** sequentially.
   - Select the **Self Test 1** button to perform **Self Test 1** independently.
   - Select the **Self Test 2** button to perform **Self Test 2** independently.

   The relevant LED changes color as follows:

- **Yellow:** The test is in progress.
- **Green:** The test has been completed and no problems were identified.
- **Red:** Problems were identified during the performance of the test.

5) Review the test results in the **Comment** area and proceed as follows:

   - If no problems were identified, proceed to the FEC test, as described in the *Front End Controller (FEC) Diagnostic Tests (for RFT Configuration)* section, on page 7-19.
   - If no problems were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
   - If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the RFT test.
   - If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory).* If the problem persists, contact your local GE Medical Systems field engineer for assistance.

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7-3-6 Front End Controller (FEC) Diagnostic Tests (for RFT Configuration)

The FEC diagnostic tests include the following:

- **Board Test:** General board test which activates the remaining tests sequentially. Each of these tests can also be performed individually.
- **Self Test:** An FEC self test generated by the DSP on the FEC board.
- **BF Cache Test:** Checks the access to the BF cache memory that stores the data for the focuser.
- **TEE Temp Test:** Checks the TEE probe temperature sensor.
- **Thr Temp Test:** Diagnoses the temperature threshold for TEE probes.
- **Pencil ID Test:** Checks the pencil ID circuit in the FEC.

Note: Before performing any of the FEC tests, perform the IMP, VME Bus and RFT tests, as described beginning on page 7-13. If an FEC test is performed without first performing these tests, and errors are identified, you must perform the RFT test, and then the VME Bus test and the IMP test, to ensure that the FEC board is the source of the error.

1) Access the *FE Diagnostics* dialog box - see Accessing the Front End Diagnostic Options on page 7 - 6.
2) In the *FE Diagnostics* dialog box, trackball to the **FEC** tab and press **Select**,
   OR
   Trackball to the **FEC** button in the **Data Flow Map** and press **Select**.
   The **FEC** tab is displayed, as shown below:

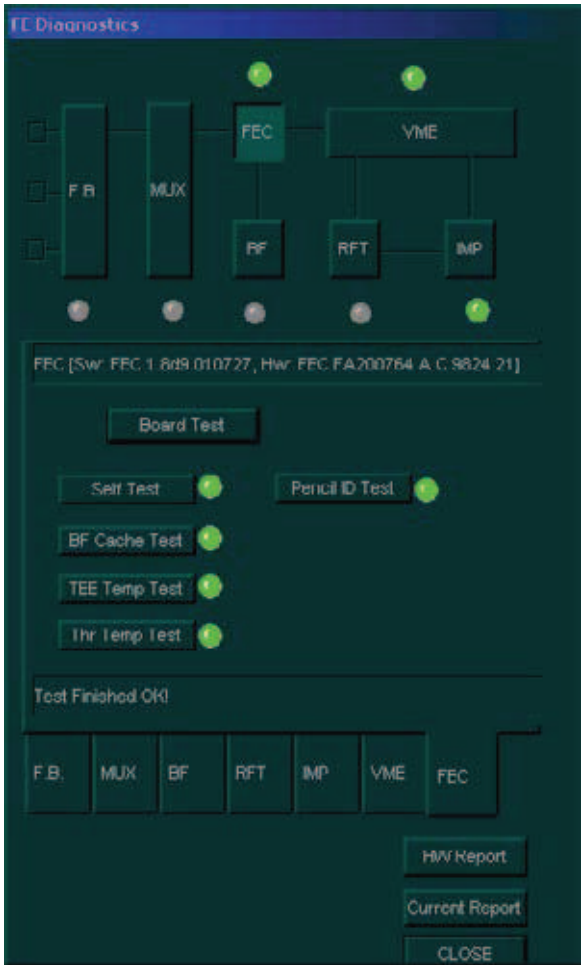

Figure 7-10 FEC Tab - FE Diagnostics Dialog Box

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3) In the **FEC** tab, verify that the **Comment** area indicates that the system is ready to perform the test.

4) Trackball to one of the following buttons and press **Select**:

- Select the **Board Test** button to perform the **Self Test**, **BF Cache Test**, **TEE Temp Test**, **Thr Temp Test** and **Pencil ID Test** sequentially.
- Select the **Self Test** button to perform the Self Test independently.
- Select the **BF Cache Test** button to perform the BF Cache Test independently.
- Select the **TEE Temp Test** button to perform the TEE Temp Test independently.
- Select the **Thr Temp Test** button to perform the Thr Temp Test independently.
- Select the **Pencil ID Test** button to perform the Pencil ID Test independently.

The relevant LED changes color as follows:

- **Yellow:** The test is in progress.
- **Green:** The test has been completed and no problems were identified.
- **Red:** Problems were identified during the performance of the test.

5) Review the test results in the **Comment** area and proceed as follows:

- If no problems were identified, proceed to the BF test, as described in the *Beamformer (BF) Diagnostic Tests* section, on page 7-21.
- If no problems were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
- If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the test.
- If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.

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7-3-7 Beamformer (BF) Diagnostic Tests

The BF diagnostic tests enable you to check the ADC output and perform a digital beamformer test.

Note: Before performing the BF tests, perform the IMP, VME Bus, RFT and FEC tests, as described beginning on page 7-13. If the BF test is performed without first performing these tests, and errors are identified, you must perform the FEC tests, then the RFT test, the VME Bus test, and the IMP test, to ensure that the BF board is the source of the error.

NOTE: When replacing the BF, perform calibration as described in the Calibration section, on page 6-14.

NOTE: IMPORTANT - Do not perform BF Calibration after operating in CW or PW scanning modes since validation will fail. Perform the BF Calibration procedure only after 2D scanning mode.

1) Access the *FE Diagnostics* dialog box, as described in the *Accessing the Front End Diagnostic Options* section, on page 7-6.

2) In the *FE Diagnostics* dialog box, trackball to the **BF** tab and press **Select**,

   OR

   Trackball to the **BF** button in the **Data Flow Map** and press **Select**.

   The **BF** tab is displayed, as shown in Figure 7-11 (or Figure 7-12) below:

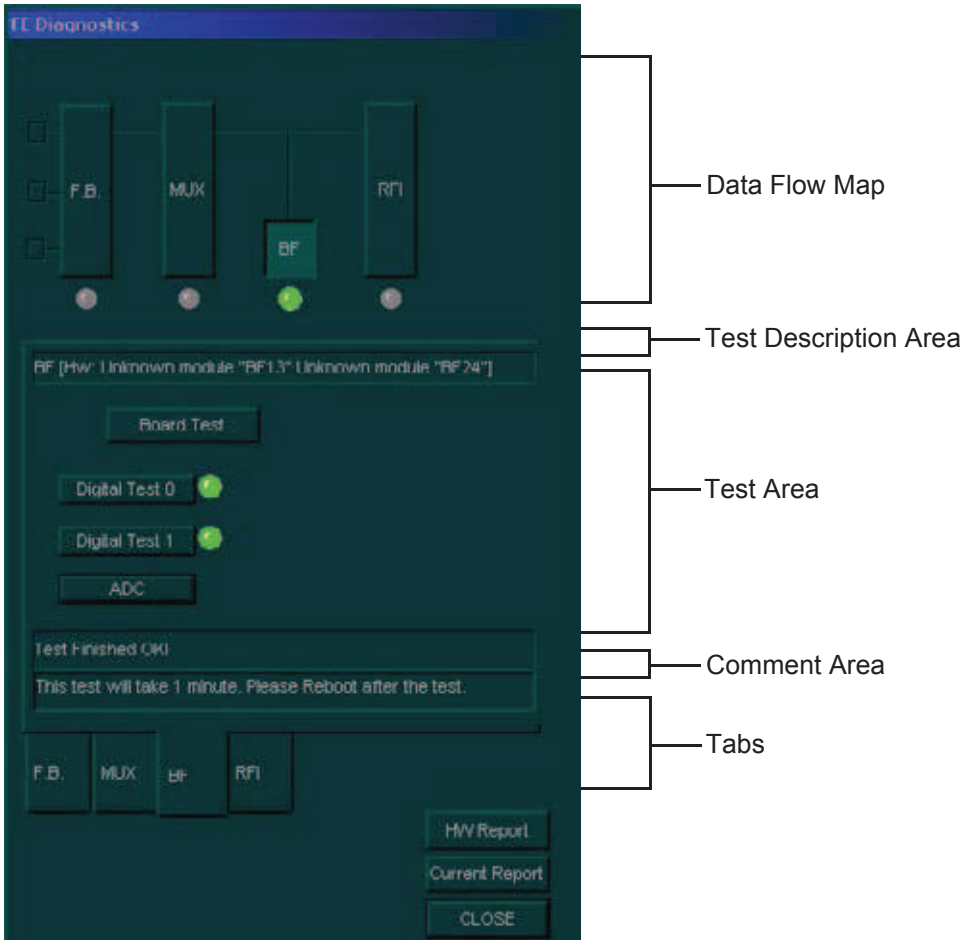

Figure 7-11 BF Tab - FE Diagnostics Dialog Box (RFI Configuration)

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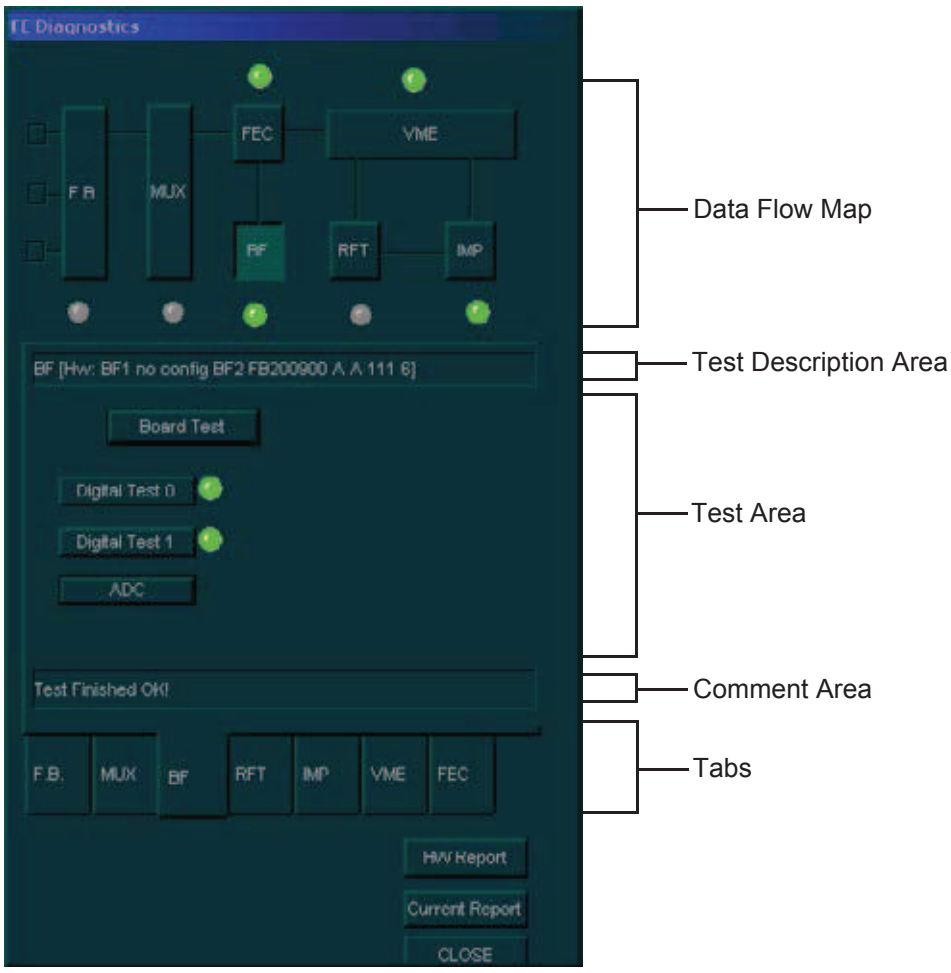

Figure 7-12 BF Tab - FE Diagnostics Dialog Box (RFT Configuration)

3) Proceed as follows: Trackball to one of the following buttons and press **Select**:

   - Trackball to the **Board Test** button and press **Select**

     OR

   - Perform the Digital Test 0 and Digital Test 1 independently, as follows. Trackball to the **Digital Test 0** button and press **Select**. When complete, trackball to the **Digital Test 1** button and press **Select** .

4) In the **BF** tab, verify that the **Comment** area indicates that the system is ready to perform the test.

5) Trackball to the **ADC** button and press **Select**. The beamformer digital test and ADC bit tests are activated sequentially. The test results are displayed, per vector, in the *Ultrasound Scope* window, as shown in Figure 7-13 below.

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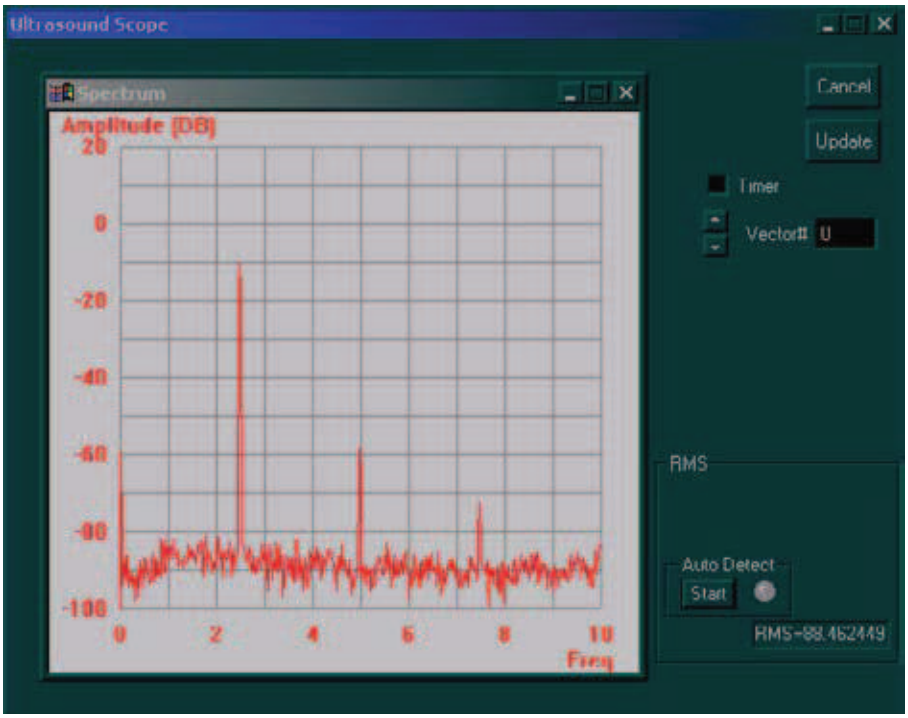

Figure 7-13 Ultrasound Scope Window

6) Under *Auto Detect*, click the **Start** button. Checking of the test results commences and the light adjacent to the button flashes green and continues to flash while *Auto Detect* is in progress. If a fault is detected, the flashing light changes to red and an error log is displayed listing the channel/s on which the test failed.

   Alternatively, review the information manually, using the scroll arrows on the right of the *Ultrasound Scope* window to select a vector between 0 and 63. The selected vector is displayed in the **Vector #** field and its test results are displayed in the **Spectrum** area.

   Check the test results for each vector, as follows:

   - Verify that the RMS level displayed in the **RMS** field is above 84 (in absolute value).
   - Verify that the amplitude at frequency 2.5 is within a range of -5 to -20.
   - Verify that the amplitude at frequency 5 is below -40.
   - Verify that the amplitude at frequency 7.5 is below -60.

Note: If the RMS level is above or below the specified level, reboot the system, perform calibration and repeat the test.

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7) Proceed as follows:

- If no problems were identified, proceed to the FB tests, as described in the *Front Board Assembly (FB) Diagnostic Tests* section, on page 7-25.
- If no problems were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
- If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the test.
- If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.

8) When finished, trackball to the **Cancel** button and press **Select**. The *FE Diagnostics* dialog box is re-displayed.

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7-3-8 Front Board Assembly (FB) Diagnostic Tests

The FB diagnostics tests check the FB circuits and boards. To avoid frequent rebooting of the system, these tests must be performed in the sequence described below. When performing FB tests out of sequence, follow the instructions displayed in the **Comment** area of the *FE Diagnostics* dialog box, and reboot as required. Refer to *Chapter 5 - Components and Function (Theory)* for additional details about the FB circuits and boards.

Note: Before performing the FB tests, make sure that the RFI (or IMP, VME Bus, RFT, FEC) and BF diagnostic tests have been performed, as described beginning on page 7-13.

If the FB tests are performed without first performing these tests, and errors are identified, you must perform the following tests (*in the order listed*) to ensure that the FB is in fact the source of the error:

For Systems with RFI Configuration:

- MUX Diagnostic Test
- Beamformer (BF) Diagnostic Test
- Radio Frequency Interface (RFI) Diagnostic Test

For Systems with RFT Configuration:

- MUX Diagnostic Test
- Beamformer (BF) Diagnostic Test
- Front End Controller (FEC) Diagnostic Test
- RFT Diagnostic Test
- VME Bus Diagnostic Test
- Image Port (IMP) Diagnostic Test

7-3-8-1 Accessing the Front Board Assembly Options

1) Access the *FE Diagnostics* dialog box, as described in the *Accessing the Front End Diagnostic Options* section, on page 7-6.
2) In the *FE Diagnostics* dialog box, trackball to the **F.B.** tab and press **Select**,

   OR

   Trackball to the **F.B.** button in the **Data Flow Maps** and press **Select**. The **F.B.** tab is displayed, as shown in Figure 7-14 on page 7-26 (or Figure 7-15 on page 7-27).

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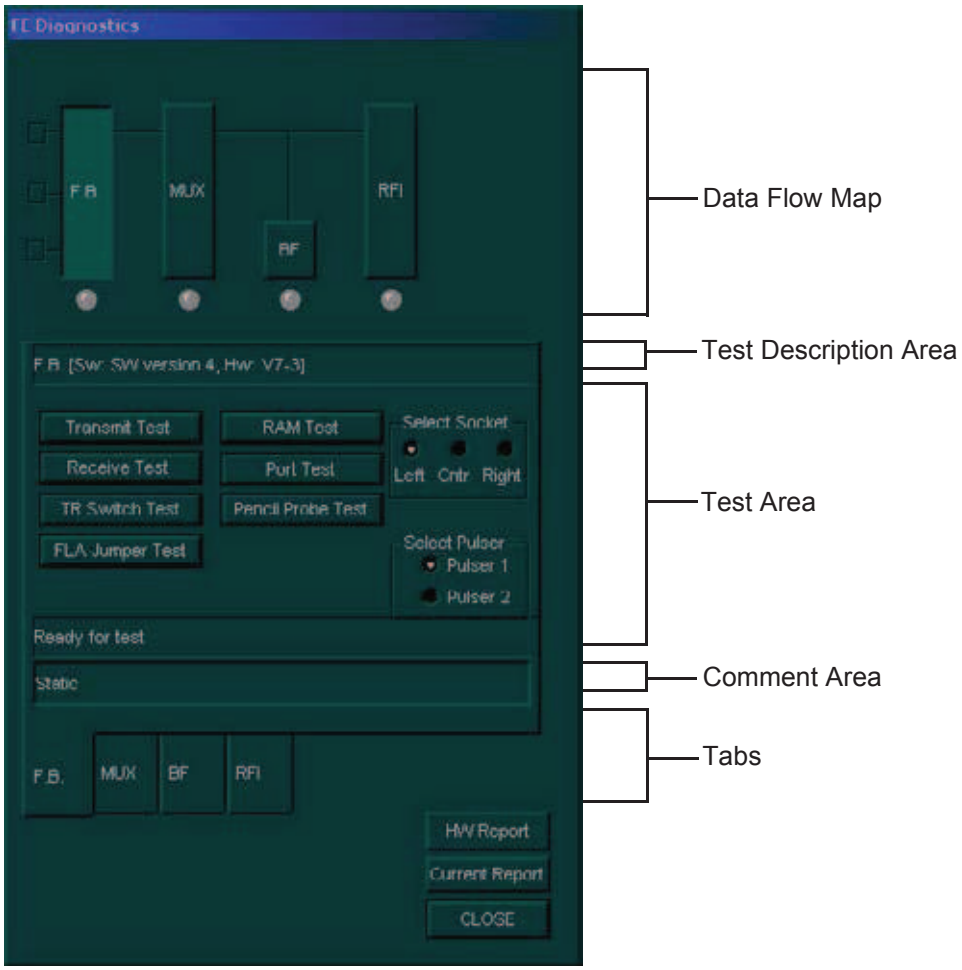

Figure 7-14 F.B. Tab - FE Diagnostics Dialog Box (RFI Configuration)

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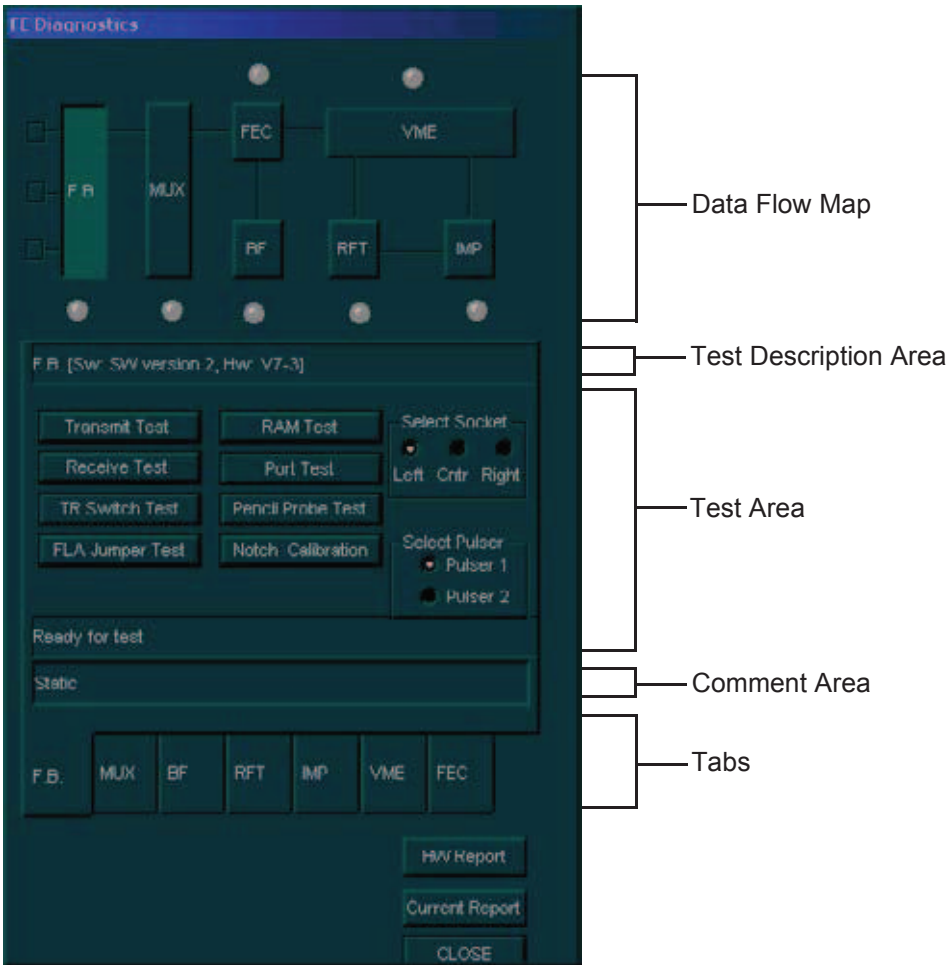

Figure 7-15 F.B. Tab - FE Diagnostics Dialog Box (RFT Configuration)

3) Trackball to the following buttons (in the order shown) and press **Select**:

   a.) **Transmit Test:** Checks the FE pulsers via the probe elements, as described in the *Transmit Test* section, on page 7-28.

   b.) **Receive Test:** Tests each amplifier output against the predefined output level, as described in the *Receive Test* section, on page 7-34.

   c.) **TR Switch Test:** Checks the transmit switches, as described in the *TR Switch Test* section, on page 7-38.

   d.) **FLA Jumper Test:** Checks the jumpers that connect the side elements to the center elements, as described in the *FLA Jumper Switch* section, on page 7-30.

   e.) **Pencil Probe Test:** Checks the transmitting channels associated relays to the pencil probe port, as described in the *Pencil Probe Test* section, on page 7-40.

   f.) **Port Test:** Checks general logic control and ports logic, as described in *Port Test* section, on page 7-44.

   g.) **RAM Test:** Checks the RAM that stores the delays for the transmitted ultrasound signals to the form focal beam, as described in the *RAM Test* section, on page 7-45.

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7-3-8-2 Transmit Test

If a solid dark line is observed during scanning, it may indicate a bad transmitting channel. The transmit test checks the FE pulsers via the probe elements, enabling you to check the transmitting channels. The transmit test is not sensitive to the receiving channels.

Note: To avoid irrelevant failure results, it is imperative that the probe used to perform the transmit test is in good condition.

1) Connect either a 7S or 3S probe and lock it in place.
2) Access the **F.B.** tab of the *FE Diagnostics* dialog box, as described in the *Accessing the Front Board Assembly Options* section, on page 7-25.
3) In the **Select Socket** area of the **F.B.** tab, trackball to the socket to which the 7S or 3S probe is connected:
   - Trackball to **Left**, **Right** or **Center** and press **Select**.
4) Trackball to **Pulser 1** (High Voltage Power Supply [HVPS] +/-80V) or **Pulser 2** (Low Voltage Power Supply [LVPS] +/-40V) and press **Select**.
5) Trackball to the **Transmit Test** button and press **Select**. The transmit test is performed and the test results are displayed in the *Report* dialog box, as shown below:

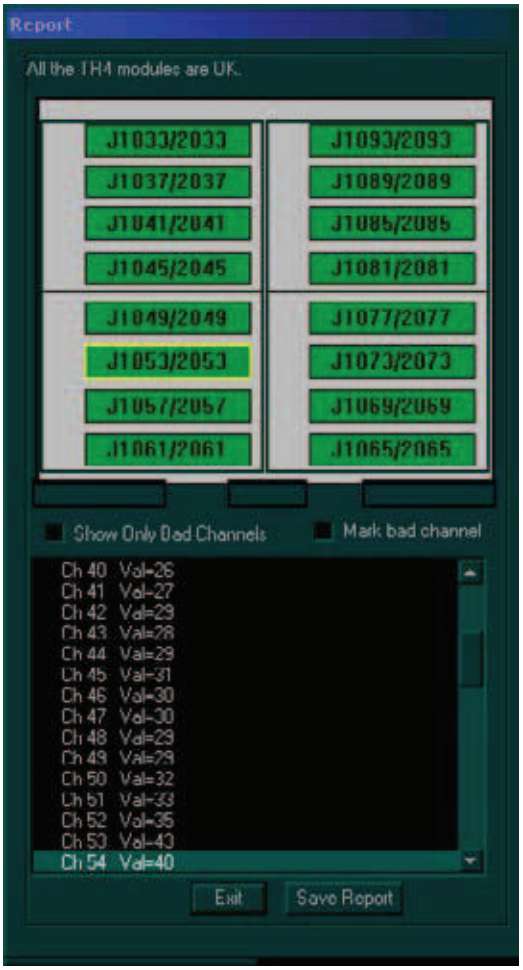

Figure 7-16 Report Dialog Box - Transmit Test

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The *Report* dialog box contains the following information:

- **Test Result Message:** Displays the test result.
- **TR4 Modules:** Displays a graphic representation of the front board (four groups of TR4 sockets). Each group consists of four TR4 sockets, each socket containing four vectors (channels), as follows:
  - Each vector is represented by a button (highlighted in green) that displays the number of the socket to which the TR4 is connected.
  - Each button is highlighted yellow when selected.
  - Each button is highlighted red if errors were detected for one or more channels.
- **Checkboxes:** Enable you to manipulate bad channels:
  - **Show Only Bad Channels:** Select this checkbox to display only bad channels in the **Display** area.
  - **Mark bad channel:** Select this checkbox to manually mark the currently selected channel as bad.
- **Vector Line:** Displays a graphic representation of the selected vector. This line is green if the vector is good, and yellow if it is bad.

6) Check the test result message in the *Report* dialog box:
   - If one or more channels were identified as bad, trackball to the **Save Report** button and press **Select**, then contact a GE Medical Systems service representative.
   - If no channels were identified as bad, mark the channels suspected as being bad as follows:
     - Trackball to each of the channels in the **Display** area and press select.
     - Trackball to the **Mark bad channel** checkbox and press **Select**.
     - Trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
   - If no errors were identified, proceed with the next test.
   - If no errors were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
   - If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the test.
   - If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.
7) Trackball to the **Exit** button and press **Select**. If required, repeat this test with a different pulser.

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7-3-8-3 FLA Jumper Switch

All the elements are connected through the transmit and receive jumpers. This test checks the jumpers that connect the side elements to the center elements. During this test, every probe element transmits and receives signals. The test has two phases, namely *Open jumper test* and *Closed jumper test*.

1) Connect the 10L (739L) probe and lock it in place.

Note: To avoid irrelevant failure results, it is imperative that *only* this probe is used and that it be in good condition.

2) Access the **F.B.** tab of the *FE Diagnostics* dialog box, as described in the *Accessing the Front Board Assembly Options* section, on page 7-25.

3) In the **Select Socket** area of the **F.B.** tab, trackball to the socket to which the 10L probe is connected:

   • Trackball to **Left**, **Right** or **Center** and press **Select**.

4) Trackball to **Pulser 1** (High Voltage Power Supply [HVPS] +/-80V) or **Pulser 2** (Low Voltage Power Supply [LVPS] +/-40V) and press **Select**.

5) Trackball to the **FLA Jumper Test** button and press **Select**. The open FLA jumper test is performed, and the test results are displayed in the *Report* dialog box, as shown below:

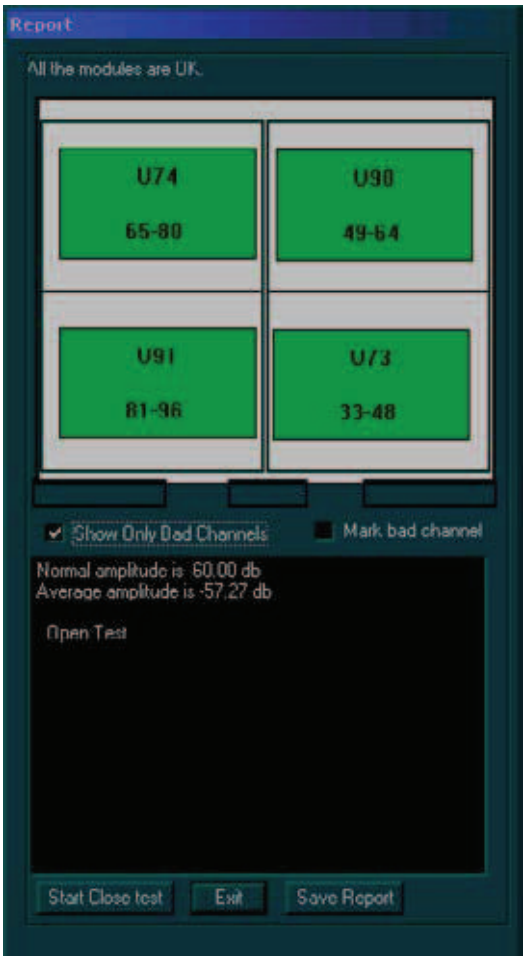

Figure 7-17 Report Dialog Box - Open FLA Jumper Test

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The *Report* dialog box contains the following information:

- **Test Result Message:** Displays the test result.
- **FB Elements:** Displays a graphic representation of the front board elements, as follows:
  - Each element is represented by a button (highlighted in green) that displays the element, and the channel number that is associated with that element.
  - Each button is highlighted yellow when selected.
  - Each button is highlighted red if errors were detected for one or more elements.
- **Checkboxes:** Enable you to manipulate bad channels:
  - **Show Only Bad Channels:** Select this checkbox to display only bad channels in the **Display** area.
  - **Mark bad channel:** Select this checkbox to manually mark the currently selected channel as bad.

6) Check the test result message and proceed as follows:
   - If one or more channels were identified as bad, trackball to the **Save Report** button and press **Select**, then contact a GE Medical Systems Service Representative.
   - If no channels were identified as bad, mark the channels suspected as being bad as follows:
     - Trackball to each of the channels in the **Display** area and press select.
     - Trackball to the **Mark bad channel** checkbox and press **Select**.
     - Trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
7) Trackball to the **Start Close test** button and press **Select**. The closed FLA jumper test is performed. and the test results are displayed in the *Report* dialog box, as shown in Figure 7-22 on page 7-40.

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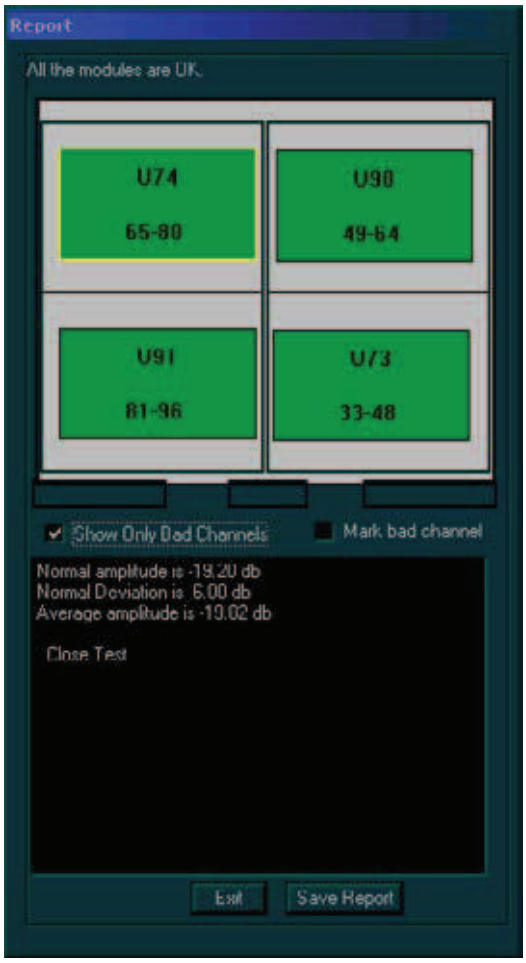

Figure 7-18 Report Dialog Box - FLA Jumper Test (Closed)

The *Report* dialog box contains the following information:

- **Test Result Message:** Displays the test result.
- **FB Elements:** Displays a graphic representation of the front board elements, as follows:
  - Each element is represented by a button (highlighted in green) that displays the element, and the channel number that is associated with that element.
  - Each button is highlighted yellow when selected.
  - Each button is highlighted red if errors were detected for one or more elements.
- **Checkboxes:** Enable you to manipulate bad channels:
  - **Show Only Bad Channels:** Select this checkbox to display only bad channels in the **Display** area.
  - **Mark bad channel:** Select this checkbox to manually mark the currently selected channel as bad.

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8) Check the test result message and proceed as follows:
   - If one or more channels were identified as bad, trackball to the **Save Report** button and press **Select**, then contact a GE Medical Systems Service Representative.
   - If no channels were identified as bad, mark the channels suspected as being bad as follows:
     - Trackball to each of the channels in the **Display** area and press select.
     - Trackball to the **Mark bad channel** checkbox and press **Select**.
     - Trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
   - If no errors were identified, proceed with the next test.
   - If no errors were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
   - If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the test.
   - If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.
9) Trackball to the **Exit** button and press **Select**. If required, repeat this test with a different pulser.

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7-3-8-4 Receive Test

The Receive Test checks each amplifier output against the predefined output level. This system test is performed in Phased Array Probe Simulation mode. The FEC board injects analog signals to the Tx amplifiers inputs after the Tx switch. The test lasts approximately 4 minutes.

Note: System re-boot is required if the tests are not being performed in the sequence described in the *Performing Front End (FE) Diagnostics* section, on page 7-5.

1) Disconnect all the probes.
2) Access the **F.B.** tab of the *FE Diagnostics* dialog box, as described in the *Accessing the Front Board Assembly Options* section, on page 7-25.
3) Trackball to **Pulser 1** (High Voltage Power Supply [HVPS] +/-80V) or **Pulser 2** (Low Voltage Power Supply [LVPS] +/-40V) and press **Select**.
4) Trackball to the **Receive Test** button and press **Select**. The receive test is performed, and the test results are displayed in the *Report* dialog box, as shown below:

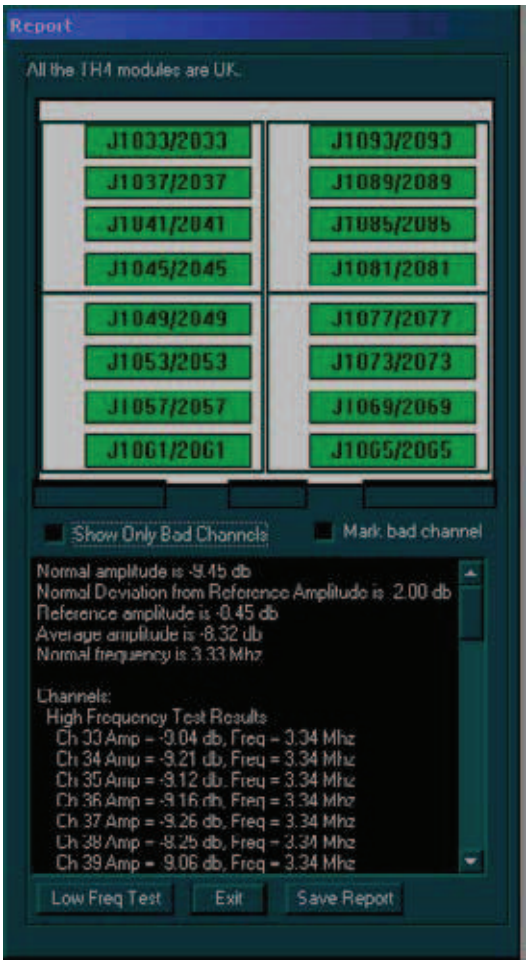

Figure 7-19 Report Dialog Box - Receive Test

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The *Report* dialog box contains the following information:

- **Test Result Message:** Displays the test result.
- **TR4 Modules:** Displays a graphic representation of the front board (four groups of TR4 sockets). Each group consists of four TR4 sockets, each socket containing four vectors (channels), as follows:
  - Each vector is represented by a button (highlighted in green) that displays the number of the socket to which the TR4 is connected.
  - Each button is highlighted yellow when selected.
  - Each button is highlighted red if errors were detected for one or more channels.
- **Checkboxes:** Enable you to manipulate bad channels:
  - **Show Only Bad Channels:** Select this checkbox to display only bad channels in the **Display** area.
  - **Mark bad channel:** Select this checkbox to manually mark the currently selected channel as bad.

5) Check the test result message and proceed as follows:
   - If one or more channels were identified as bad, trackball to the **Save Report** button and press **Select**, then contact a GE Medical Systems Service Representative.
   - If no channels were identified as bad, mark the channels suspected as being bad as follows:
     - Trackball to each of the channels in the **Display** area and press **Select**.
     - Trackball to the **Mark bad channel** checkbox and press **Select**.
     - Trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
6) Trackball to the **Low Freq Test** button and press **Select**. The receive test is performed in low frequency mode, and the test results are displayed in the *Report* dialog box, as shown in Figure 7-20 on page 7-36:

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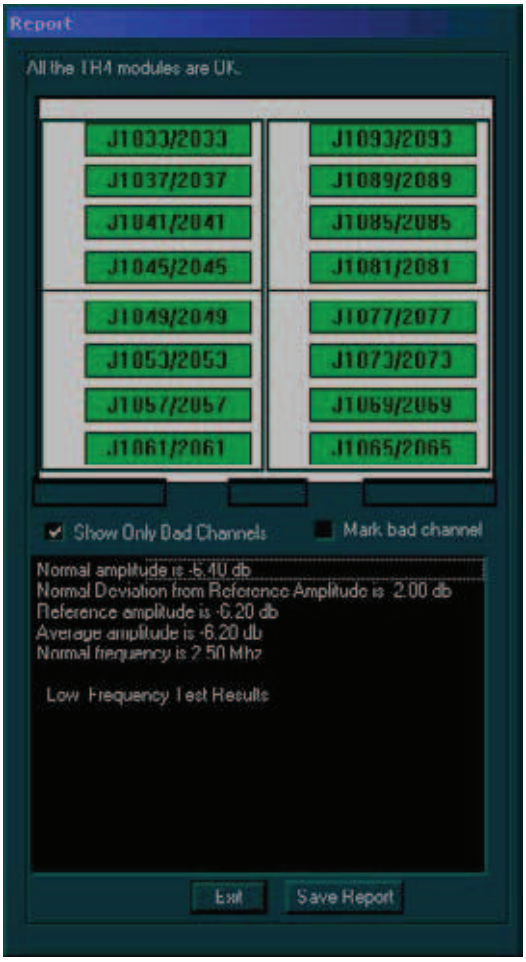

Figure 7-20 Report Dialog Box - Receive Test Low Frequency

The *Report* dialog box contains the following information:

- **Test Result Message:** Displays the test result.
- **TR4 Modules:** Displays a graphic representation of the front board (four groups of TR4 sockets). Each group consists of four TR4 sockets, each socket containing four vectors (channels), as follows:
  - Each vector is represented by a button (highlighted in green) that displays the number of the socket to which the TR4 is connected.
  - Each button is highlighted yellow when selected.
  - Each button is highlighted red if errors were detected for one or more channels.
- **Checkboxes:** Enable you to manipulate bad channels:
  - **Show Only Bad Channels:** Select this checkbox to display only bad channels in the **Display** area.
  - **Mark bad channel:** Select this checkbox to manually mark the currently selected channel as bad.

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7) Check the test result message and proceed as follows:
   - If one or more channels were identified as bad, trackball to the **Save Report** button and press **Select**, then contact a GE Medical Systems Service Representative.
   - If no channels were identified as bad, mark the channels suspected as being bad as follows:
     - Trackball to each of the channels in the **Display** area and press select.
     - Trackball to the **Mark bad channel** checkbox and press **Select**.
     - Trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
   - If no errors were identified, proceed with the next test.
   - If no errors were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
   - If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the test.
   - If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.
8) Trackball to the **Exit** button and press **Select**. If required, repeat this test with a different pulser.

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7-3-8-5 TR Switch Test

If a solid line is observed during scanning, it may indicate a bad TR switch. This test checks the transmit switches.

1) Connect a 3S probe and lock it in place.

Note: To avoid irrelevant failure results, it is imperative that the probe be in good condition.

2) Access the **F.B.** tab of the *FE Diagnostics* dialog box, as described in the *Accessing the Front Board Assembly Options* section, on page 7-25.

3) In the **Select Socket** area of the **F.B.** tab, trackball to the socket to which the 3S probe is connected:

   • Trackball to **Left**, **Right** or **Center** and press **Select**.

4) Trackball to **Pulser 1** (High Voltage Power Supply [HVPS] +/-80V) or **Pulser 2** (Low Voltage Power Supply [LVPS] +/-40V) and press **Select**.

5) Trackball to the **TR Switch Test** button and press **Select**. The TR switch test is performed, and the test results are displayed in the *Report* dialog box, as shown below:

Figure 7-21 Report Dialog Box - TR Switch Test

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The *Report* dialog box contains the following information:

- **Test Result Message:** Displays the test result.
- **TR4 Modules:** Displays a graphic representation of the front board (four groups of TR4 sockets). Each group consists of four TR4 sockets, each socket containing four vectors (channels), as follows:
  - Each vector is represented by a button (highlighted in green) that displays the number of the socket to which the TR4 is connected.
  - Each button is highlighted yellow when selected.
  - Each button is highlighted red if errors were detected for one or more channels.
- **Checkboxes:** Enable you to manipulate bad channels:
  - **Show Only Bad Channels:** Select this checkbox to display only bad channels in the **Display** area.
  - **Mark bad channel:** Select this checkbox to manually mark the currently selected channel as bad.

6) Check the test result message and proceed as follows:
   - If one or more channels were identified as bad, trackball to the **Save Report** button and press **Select**, then contact a GE Medical Systems Service Representative.
   - If no channels were identified as bad, mark the channels suspected as being bad as follows:
     - Trackball to each of the channels in the **Display** area and press select.
     - Trackball to the **Mark bad channel** checkbox and press **Select**.
     - Trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
   - If no errors were identified, proceed with the next test.
   - If no errors were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
   - If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the test.
   - If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.
7) Trackball to the **Exit** button and press **Select**. If required, repeat this test with a different pulser.

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7-3-8-6 Pencil Probe Test

If a solid black line is observed during scanning, it may indicate a bad transmitting channel. The pencil probe test checks the transmitting channels associated relays to the pencil probe port. This test is not for sensitive receiving channels.The test has two phases, namely the *open* pencil probe test and the *close* pencil probe test.

1) Connect a 2D pencil probe.
2) Access the **F.B.** tab of the *FE Diagnostics* dialog box, as described in the *Accessing the Front Board Assembly Options* section, on page 7-25.
3) Trackball to **Pulser 1** (High Voltage Power Supply [HVPS] ±80V) or **Pulser 2** (Low Voltage Power Supply [LVPS] ±40V) and press **Select**.
4) Trackball to the **Pencil Probe Test** button and press **Select**. The pencil probe test is performed, and the test results are displayed in the *Report* dialog box, as shown below:

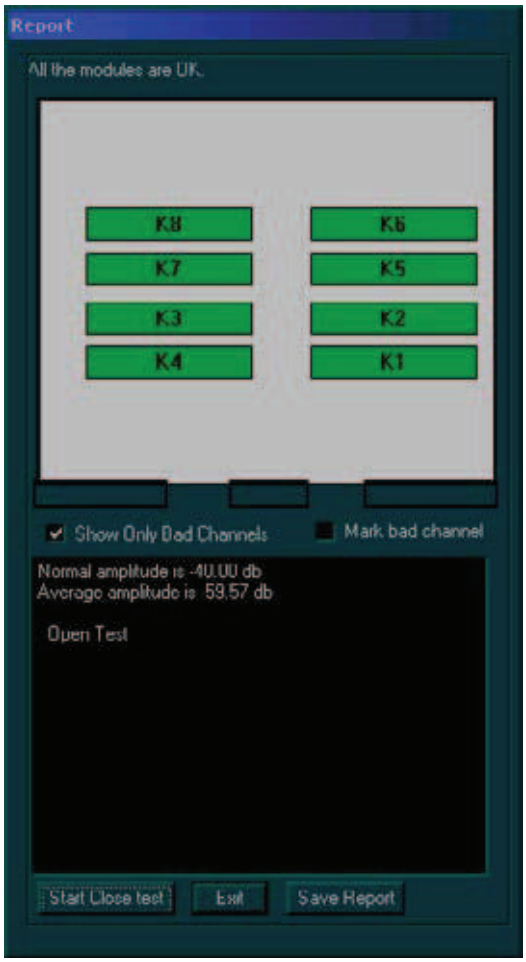

Figure 7-22 Report Dialog Box - Pencil Probe Test (Open)

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The *Report* dialog box includes the following:

- **Test Result Message:** Displays the test result.
- **Pencil Probe Relays:** Displays a graphic representation of the eight front board pencil probe relays, as follows:
  - Each relay is represented by a button (highlighted in green) that displays the relay number.
  - Each button is highlighted in yellow when selected.
  - Each button is highlighted in red if errors were detected for one or more relays.
- **Checkboxes:** Enable you to manipulate bad channels:
  - **Show Only Bad Channels:** Select this checkbox to display only the bad channels in the **Display** area.
  - **Mark bad Channel:** Select this checkbox to manually mark the currently selected channel as bad.

5) Check the test result message and proceed as follows:
   - If one or more relays were identified as bad, trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
   - If no relays were identified as bad, mark the channels suspected as being bad as follows:
     - Trackball to the channel in the Display area and press **Select**.
     - Trackball to the **Mark bad channel** checkbox and press **Select**. Repeat as required to mark additional channels.
     - Trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
6) Trackball to the **Start Close test** and press **Select**. The pencil probe test (close) is performed and the test results are displayed in the *Report* dialog box, as shown in Figure 7-23 on page 7-42.

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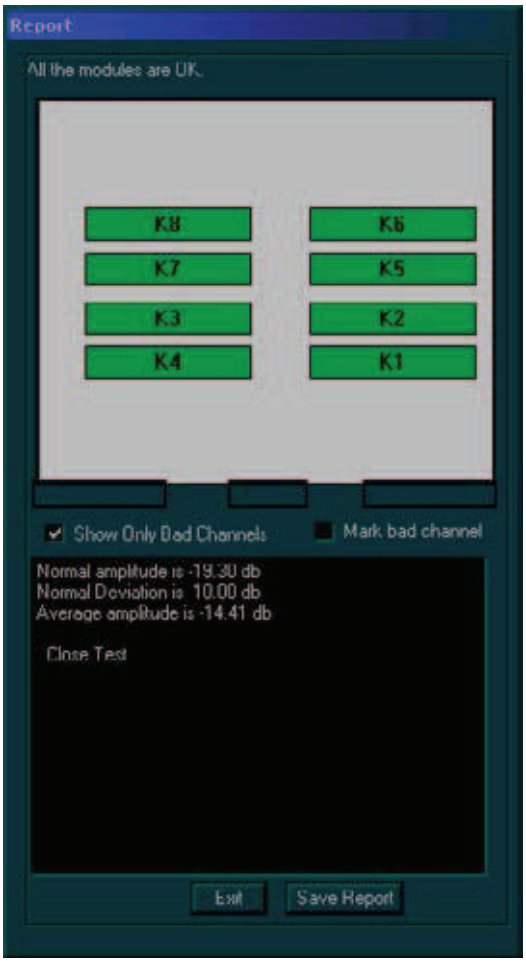

Figure 7-23 Report Dialog Box - Pencil Probe Test (Close)

The *Report* dialog box includes the following:

- **Test Result Message:** Displays the test result.
- **Pencil Probe Relays:** Displays a graphic representation of the eight front board pencil probe relays, as follows:
  - Each relay is represented by a button (highlighted in green) that displays the relay number.
  - Each button is highlighted in yellow when selected.
  - Each button is highlighted in red if errors were detected for one or more relays.
- **Checkboxes:** Enable you to manipulate bad channels:
  - **Show Only Bad Channels:** Select this checkbox to display only the bad channels in the **Display** area.
  - **Mark bad Channel:** Select this checkbox to manually mark the currently selected vector as bad.

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7) Check the test result message and proceed as follows:
   - If one or more relays were identified as bad, trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
   - If no relays were identified as bad, mark the channels suspected as being bad as follows:
     - Trackball to the channel in the Display area and press **Select**.
     - Trackball to the **Mark bad channel** checkbox and press **Select**. Repeat as required to mark additional channels.
     - Trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
   - If no errors were identified, proceed with the next test.
   - If no errors were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
   - If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the test.
   - If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.
8) Trackball to the **Exit** button and press **Select**. If required, repeat this test with a different pulser.

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7-3-8-7 Port Test

The Port test enables you to check the general logic control and ports logic.

Note: You must reboot the system after performing the Port test.

1) Disconnect all probes.
2) Access the **F.B.** tab of the *FE Diagnostics* dialog box, as described in the *Accessing the Front Board Assembly Options* section, on page 7-25.
3) Trackball to the **Port Test** button and press **Select**. The port test is performed and the results are displayed in the **Comments** area.
4) Check the test results and proceed as follows:
   - If no errors were identified, proceed with the next test.
   - If no errors were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
   - If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the test.
   - If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.
5) Reboot the system.

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7-3-8-8 RAM Test

The RAM test enables you to check the RAM that stores the delays for the transmitted ultrasound signals to the form focal beam.

Note: You must reboot the system after performing the RAM test.

1) Access the **F.B.** tab of the *FE Diagnostics* dialog box, as described in the *Accessing the Front Board Assembly Options* section, on page 7-25.

2) Trackball to the **RAM Test** button and press **Select**. The RAM test is performed and the results are displayed in the **Comments** area, as shown in Figure 7-24 (or Figure 7-25) below:

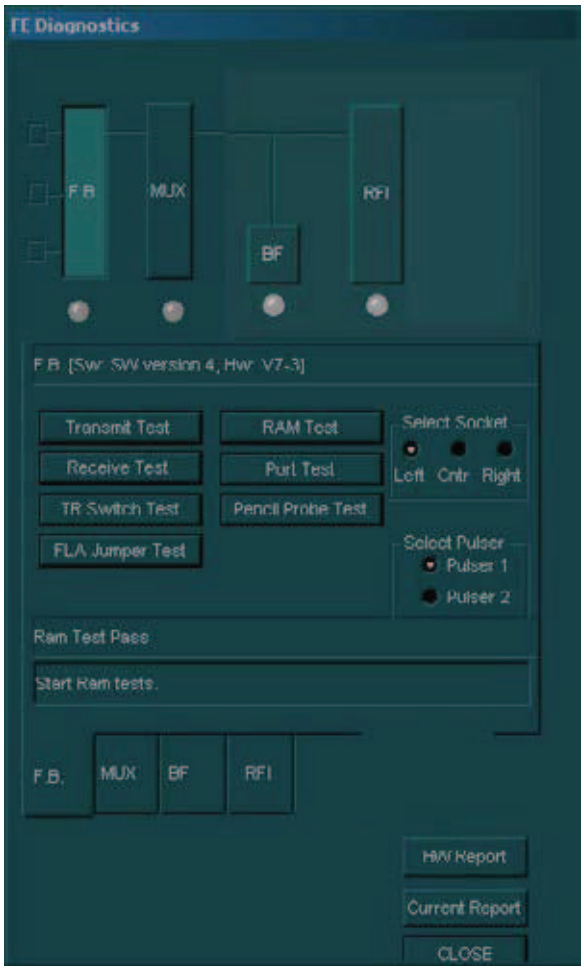

Figure 7-24 F.B. Tab - FE Diagnostics Dialog Box - RAM Test (RFI Configuration)

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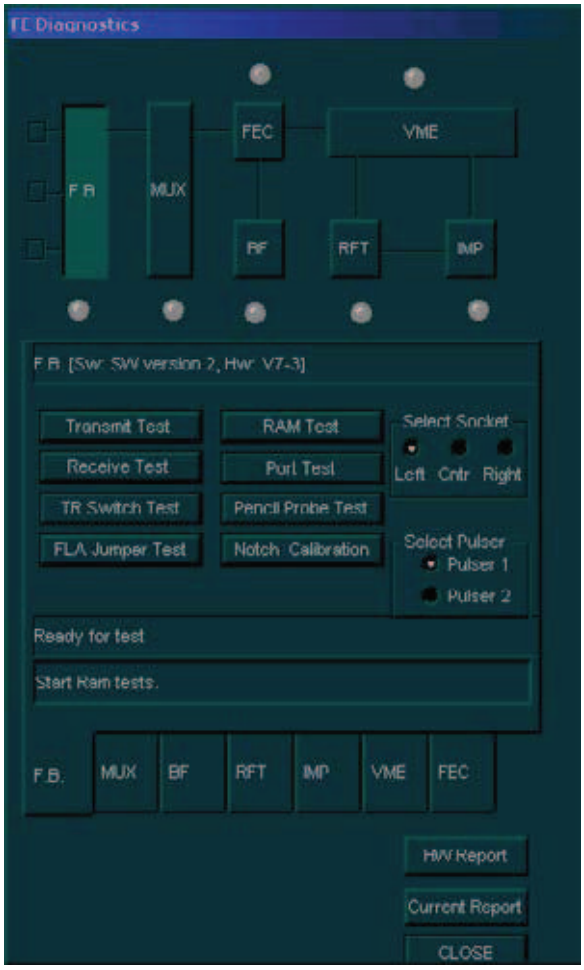

Figure 7-25 F.B. Tab - FE Diagnostics Dialog Box - RAM Test (RFT Configuration)

3) Check the test results and proceed as follows:
   - If no errors were identified, proceed with the next test.
   - If no errors were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
   - If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the test.
   - If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.
4) Reboot the system.

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7-3-9 MUX Diagnostic Tests

*NOTE: The **Select Socket** and **Select Supply** options are not relevant for this test.*

7-3-9-1 Accessing the MUX Diagnostic Test Options

1) Access the *FE Diagnostics* dialog box, as described in the *Accessing the Front End Diagnostic Options* section, on page 7-6.

2) In the *FE Diagnostics* dialog box, trackball to the **MUX** tab and press **Select**,

   OR

   Trackball to the **MUX** button in the **Data Flow Maps** and press **Select**. The **MUX** tab is displayed, as shown in Figure 7-26 (or Figure 7-27) below:

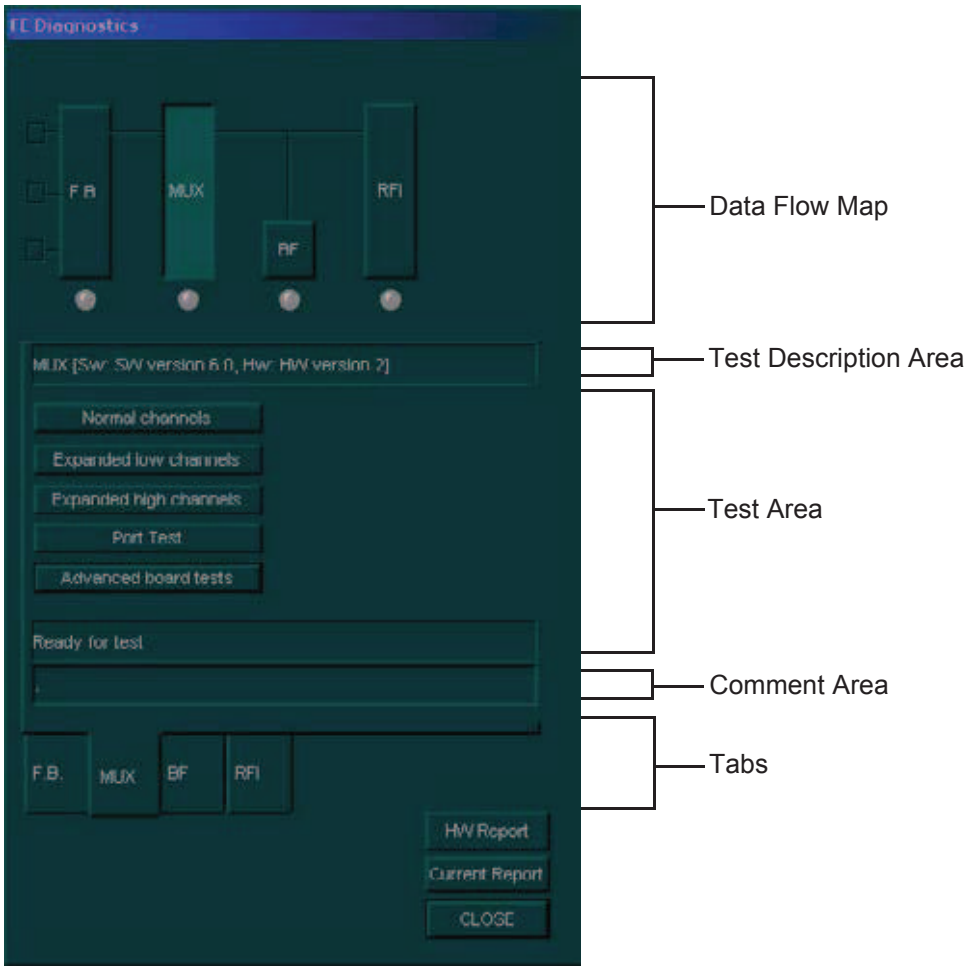

Figure 7-26 MUX Tab - FE Diagnostics Dialog Box (RFI Configuration)

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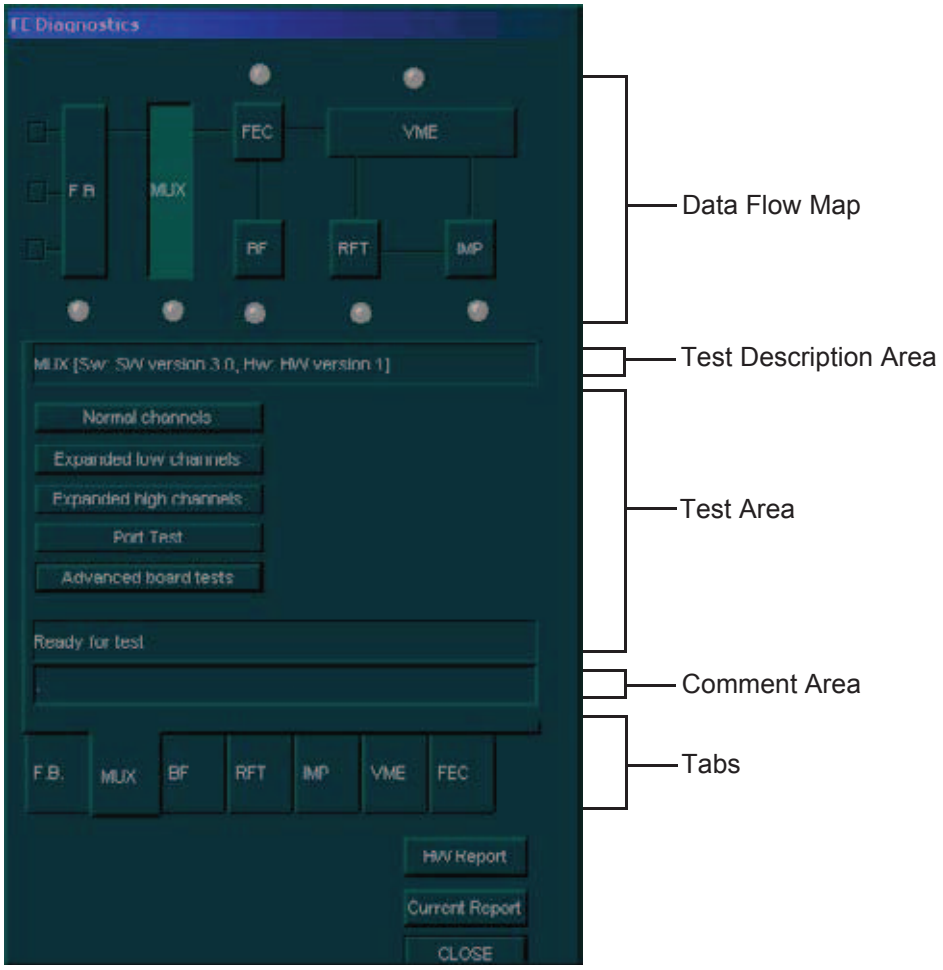

Figure 7-27 MUX Tab - FE Diagnostics Dialog Box (RFT Configuration)

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3) Trackball to each of the following buttons in turn (in the order stated below) and press **Select** to perform the specific test:

- **Normal channels:** Test the output channels from the input channels, as described in the Normal Channels Diagnostic Tests below.
- **Expanded low channels:** Tests output signals in CW-Mode only, when the input channels are connected to the output channels, as described in the *Expanded Low Channels Diagnostic Tests* section, on page 7-54.
- **Expanded high channels:** Tests the output signals from the input of the high channels, as described in the *Expanded High Channels Diagnostic Tests* section, on page 7-55.
- **Port Test:** Performs a general logic test, as described in the *Port Test* section, on page 7-56.
- **Advanced board tests:** The advanced board tests are described in the *Advanced Board Tests* section, on page 7-58. This includes procedure instructions for performing the following tests:
  - TEE Probe Control on page 7 - 58
  - AC Power Input Test on page 7 - 60.
  - LVPS Voltage Test on page 7 - 62.
  - HVPS Voltage Test on page 7 - 63.
  - Temp Test on page 7 - 64.
  - Show History on page 7 - 65.

7-3-9-2 Normal Channels Diagnostic Tests

Tests the output channels from the input channels. This test setting is used for all modes, except CW-Mode.

The Normal Channels Diagnostic Tests check each amplifier output against the predefined output level. This system test is performed in Phased Array Probe Simulation mode. The FEC board injects analog signals to the Tx amplifiers inputs after the Tx switch. The test lasts approximately 4 minutes.

Note: System re-boot is required if the tests are not being performed in the sequence described in the *Performing Front End (FE) Diagnostics* section, on page 7-5.

1) Disconnect all the probes.
2) Access the **F.B.** tab of the *FE Diagnostics* dialog box, as described in the *Accessing the Front Board Assembly Options* section, on page 7-25.
3) Trackball to **Pulser 1** (High Voltage Power Supply [HVPS] +/-80V) or **Pulser 2** (Low Voltage Power Supply [LVPS] +/-40V) and press **Select**.

Trackball to the **Normal Channels Test** button and press **Select**. The normal channels diagnostic test is performed, and the test results are displayed in the *Report* dialog box, as shown below:

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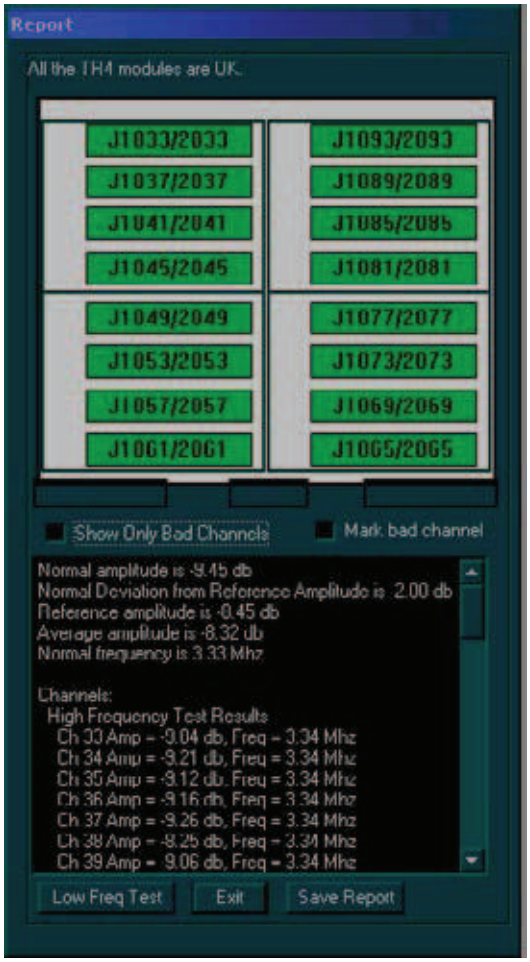

Figure 7-28 Normal Channels Diagnostic Test

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The *Report* dialog box contains the following information:

- **Test Result Message:** Displays the test result.
- **TR4 Modules:** Displays a graphic representation of the front board (four groups of TR4 sockets). Each group consists of four TR4 sockets, each socket containing four vectors (channels), as follows:
  - Each vector is represented by a button (highlighted in green) that displays the number of the socket to which the TR4 is connected.
  - Each button is highlighted yellow when selected.
  - Each button is highlighted red if errors were detected for one or more channels.
- **Checkboxes:** Enable you to manipulate bad channels:
  - **Show Only Bad Channels:** Select this checkbox to display only bad channels in the **Display** area.
  - **Mark bad channel:** Select this checkbox to manually mark the currently selected channel as bad.

4) Check the test result message and proceed as follows:
   - If one or more channels were identified as bad, trackball to the **Save Report** button and press **Select**, then contact a GE Medical Systems Service Representative.
   - If no channels were identified as bad, mark the channels suspected as being bad as follows:
     - Trackball to each of the channels in the **Display** area and press **Select**.
     - Trackball to the **Mark bad channel** checkbox and press **Select**.
     - Trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
5) Trackball to the **Low Freq Test** button and press **Select**. The normal channels diagnostic test is performed in low frequency mode, and the test results are displayed in the *Report* dialog box, as shown in Figure 7-29 on page 7-52:

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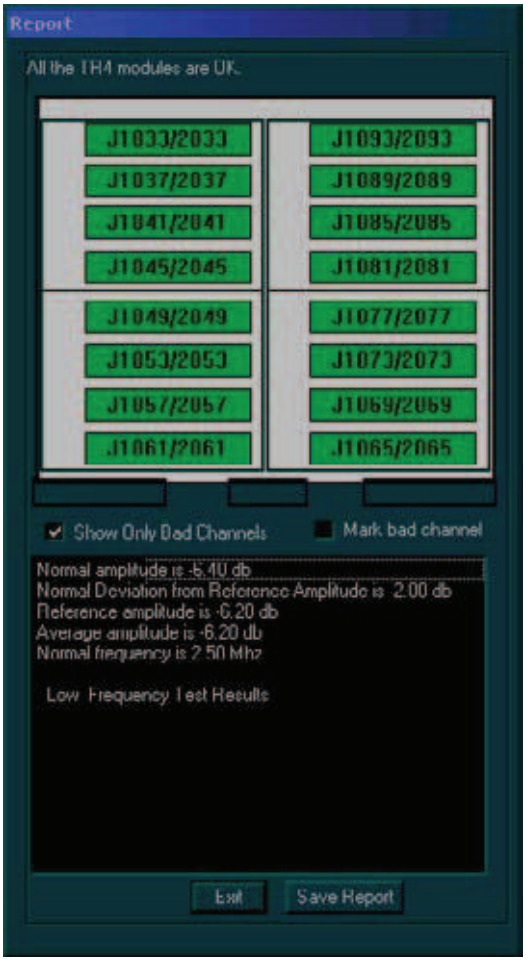

Figure 7-29 Report Dialog Box - Normal Channels Test Low Frequency

The *Report* dialog box contains the following information:

- **Test Result Message:** Displays the test result.
- **TR4 Modules:** Displays a graphic representation of the front board (four groups of TR4 sockets). Each group consists of four TR4 sockets, each socket containing four vectors (channels), as follows:
  - Each vector is represented by a button (highlighted in green) that displays the number of the socket to which the TR4 is connected.
  - Each button is highlighted yellow when selected.
  - Each button is highlighted red if errors were detected for one or more channels.
- **Checkboxes:** Enable you to manipulate bad channels:
  - **Show Only Bad Channels:** Select this checkbox to display only bad channels in the **Display** area.
  - **Mark bad channel:** Select this checkbox to manually mark the currently selected channel as bad.

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6) Check the test result message and proceed as follows:
   - If one or more channels were identified as bad, trackball to the **Save Report** button and press **Select**, then contact a GE Medical Systems Service Representative.
   - If no channels were identified as bad, mark the channels suspected as being bad as follows:
     - Trackball to each of the channels in the **Display** area and press select.
     - Trackball to the **Mark bad channel** checkbox and press **Select**.
     - Trackball to **Save Report** and press **Select**, and contact a GE Medical Systems service representative.
   - If no errors were identified, proceed with the next test.
   - If no errors were identified but the problem persists, contact your local GE Medical Systems field engineer for assistance.
   - If errors were identified but the results were marginal, perform calibration, as described in the *Calibration* section, on page 6-14, and then repeat the test.
   - If errors were identified and the results were not marginal, verify that all image port and PCI bridge cables are connected and functioning properly, as described in *Chapter 5 - Components and Function (Theory)*. If the problem persists, contact your local GE Medical Systems field engineer for assistance.
7) Trackball to the **Exit** button and press **Select**. If required, repeat this test with a different pulser.

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7-3-9-3 Expanded Low Channels Diagnostic Tests

Tests output signals in CW-Mode only, when the input channels are connected to the output channels. If one channel is missing, the output will be -6db. The input signals come from either a 3S or a 7S probe.

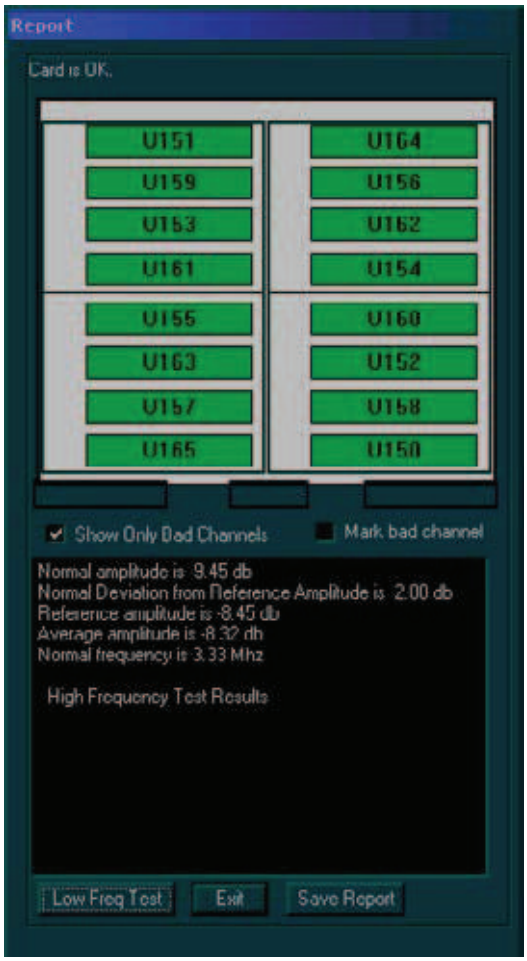

Figure 7-30 Expanded Low Channels Diagnostic Tests

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7-3-9-4 Expanded High Channels Diagnostic Tests

Tests the output signals from the input of the high channels. If one channel is missing, the output will be -6db. The input signals come from either a 3S or a 7S probe.

Figure 7-31 Expanded High Channels Diagnostic Tests

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7-3-9-5 Port Test

The Port test is a general logic control test.

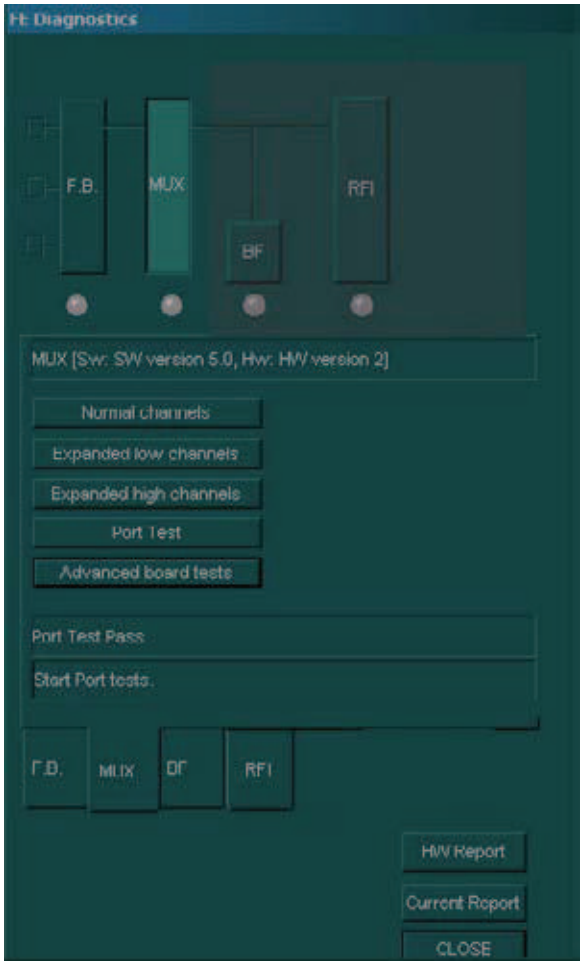

Figure 7-32 Port Test (RFI Configuration)

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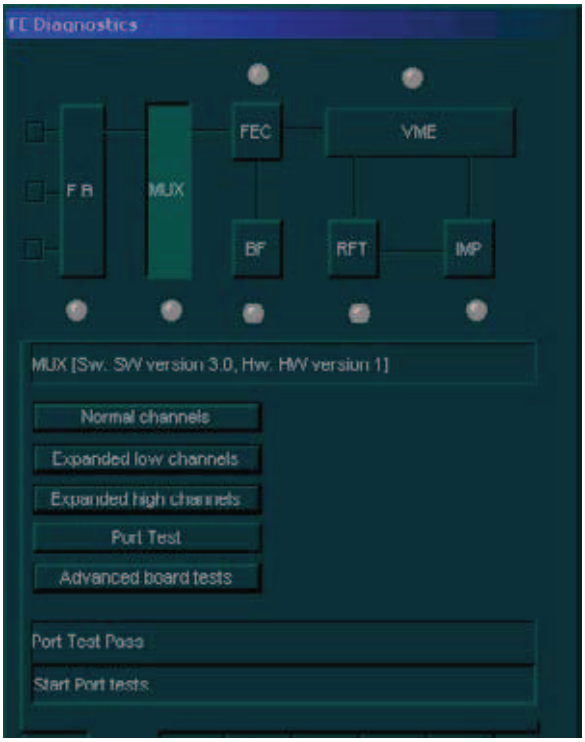

Figure 7-33 Port Test (RFT Configuration)

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7-3-9-6 Advanced Board Tests

The advanced board tests check two additional parts of the MUX Board: *TEE probe control* and *Monitoring*, as follows:

- TEE probe control enables you to check different positions of the probe; by changing the probe angle, you are able to verify its normal operation.
- Monitoring enabled you to check the HVPS and LVPS voltages, and the AC Power Input, as well as temperatures.

7-3-9-6-1 TEE Probe Control

The TEE probe control test checks the position setting of the probe, as well as its normal operation.

1) Access the MUX tab of the FB Diagnostics dialog box, as described in the *Accessing the MUX Diagnostic Test Options* section, on page 7-47.
2) Trackball to the **Advanced board tests** button and press **Select**. The *Advanced System Tests* options are displayed, as shown in Figure 7-34 on page 7-58.

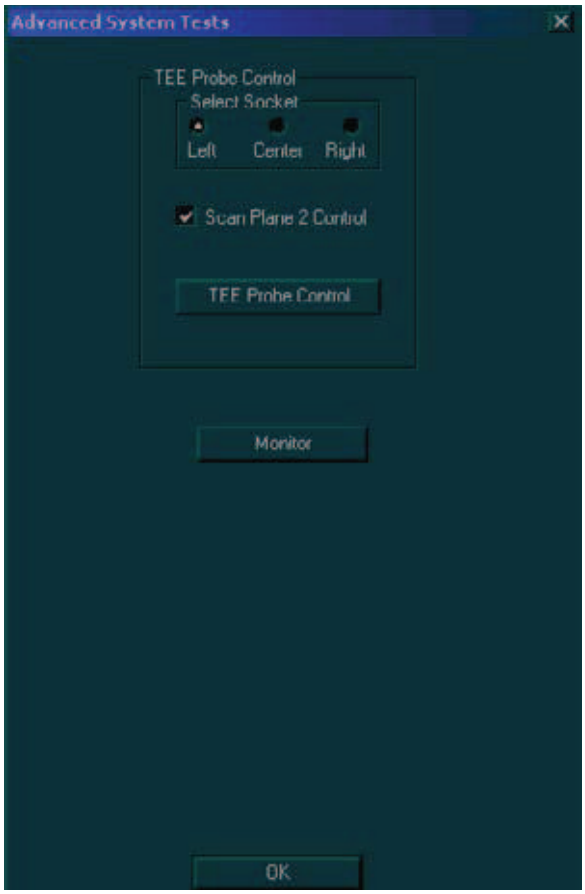

Figure 7-34 MUX Advanced System Tests Options

3) Select the radio button next to the appropriate socket.
4) Trackball to the **TEE Probe Control** button and press **Select**. The *TEE Probe Test* dialog box is displayed, as shown in Figure 7-35, with all the probe settings.

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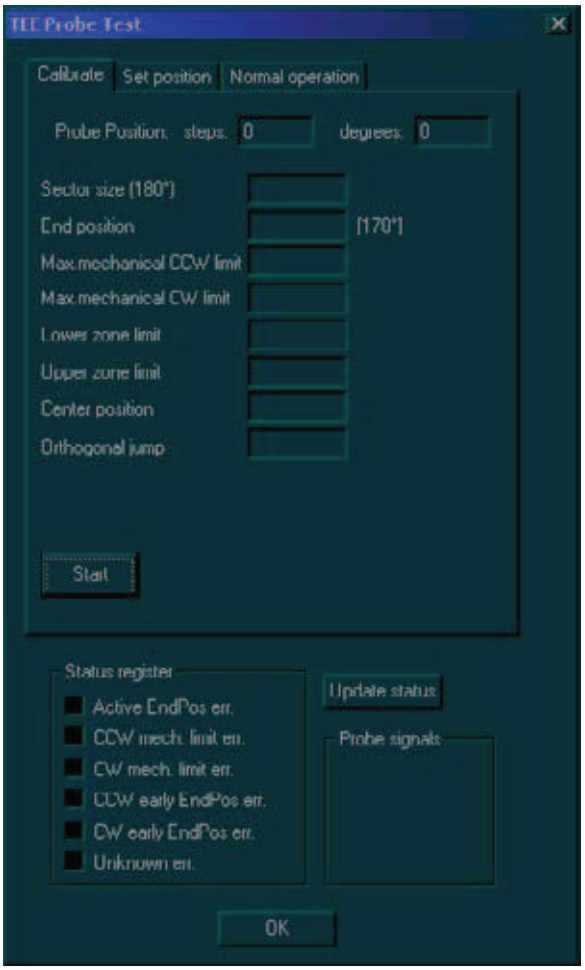

Figure 7-35 TEE Probe Test Dialog Box

5) Verify the test results, and then trackball to the **OK** button and press **Select**.

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7-3-9-6-2 AC Power Input Test

The AC power input test measures the AC input voltage deviation from the nominal input voltage (accuracy by percentage).

1) Access the MUX tab of the FB Diagnostics dialog box, as described in the *Accessing the MUX Diagnostic Test Options* section, on page 7-47.
2) Trackball to the **Advanced board tests** button and press **Select**. The *Advanced System Tests* options are displayed, as shown in Figure 7-34 on page 7-58.
3) Trackball to the **Monitor** button and press **Select**. The *View Power* options are displayed, as shown below:

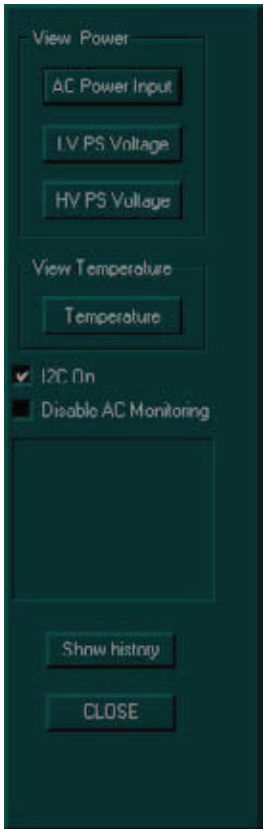

Figure 7-36 View Power Options

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4) Trackball to the **AC Power Input** button and press **Select**. The *AC Power Input* dialog box is displayed:

Figure 7-37 AC Power Input Dialog Box

5) Trackball to the **Show** button and press **Select** to display the voltage.

Note: For repeat readings, select **Loop every** and set the reading time cycle.

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7-3-9-6-3 LVPS Voltage Test

The LVPS test measures the LVPS voltages. The voltage range is displayed next to the measured voltage. All the voltages can be measured with DVM on the front board test point.

1) Access the **MUX** tab of the *FB Diagnostics* dialog box, as described in the *Accessing the MUX Diagnostic Test Options* section, on page 7-47.
2) Trackball to the **Advanced board tests** button and press **Select**. The *Advanced System Tests* options are displayed, as shown in Figure 7-34 on page 7-58.
3) Trackball to the **Monitor** button and press **Select**. The *View Power* options are displayed, as shown in Figure 7-36 on page 7-60.
4) Trackball to the **LV PS Voltage** button and press **Select**. The LVPS voltage ranges are displayed, as shown below:

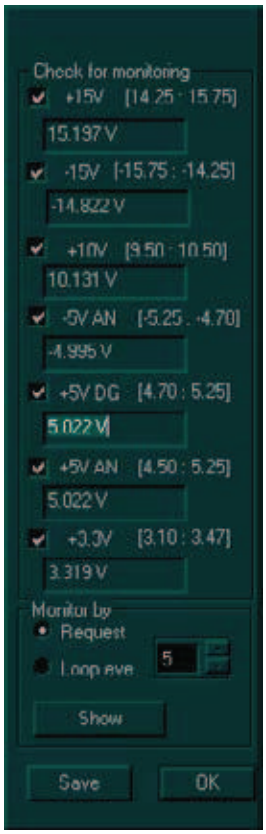

Figure 7-38 LVPS Voltage Ranges

5) Trackball to the **Show** button and press **Select** to display the voltages.

Note: For repeat readings, select **Loop every** and set the reading time cycle.

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7-3-9-6-4 HVPS Voltage Test

The HVPS test measures the Tx voltages. The current values are displayed next to the measured values. All the voltages can be measured with DVM on the front board test point.

Note: The Tx voltage may vary according to the operating mode.

1) Access the **MUX** tab of the *FB Diagnostics* dialog box, as described in the *Accessing the MUX Diagnostic Test Options* section, on page 7-47.
2) Trackball to the **Advanced board tests** button and press **Select**. The *Advanced System Tests* options are displayed, as shown in Figure 7-34 on page 7-58.
3) Trackball to the **Monitor** button and press **Select**. The *View Power* options are displayed, as shown in Figure 7-36 on page 7-60.
4) Trackball to the **HV PS Voltage** button and press **Select**. The Tx voltages are displayed, as shown below:

Figure 7-39 HVPS Voltage Ranges

5) Trackball to the **Show** button and press **Select** to display the voltages.

Note: For repeat readings, select **Loop every** and set the reading time cycle.

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7-3-9-6-5 Temp Test

The Temp test displays the temperature at the Front End crate, as well as the temperature of the AC distribution box.

1) Access the **MUX** tab of the *FB Diagnostics* dialog box, as described in the *Accessing the MUX Diagnostic Test Options* section, on page 7-47.
2) Trackball to the **Advanced board tests** button and press **Select**. The *Advanced System Tests* options are displayed, as shown in Figure 7-34 on page 7-58.
3) Trackball to the **Monitor** button and press **Select**. The *View Power* options are displayed, as shown in Figure 7-36 on page 7-60.
4) Trackball to the **Temperature** button and press **Select**. The temperatures are displayed, as shown below:

Figure 7-40 Temperatures

5) Trackball to the **Show** button and press **Select** to display the temperatures.

Note: For repeat readings, select **Loop every** and set the reading time cycle.

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7-3-9-6-6 Show History

The **Show History** option in the *View Power* dialog box displays selected test results by *year*, *month* and *day*.

1) Access the **MUX** tab of the *FB Diagnostics* dialog box, as described in the *Accessing the MUX Diagnostic Test Options* section, on page 7-47.
2) Trackball to the **Advanced board tests** button and press **Select**. The *Advanced System Tests* options are displayed, as shown in Figure 7-34 on page 7-58.
3) Trackball to the **Monitor** button and press **Select**. The *View Power* options are displayed, as shown in Figure 7-36 on page 7-60.
4) Trackball to the **View History** button and press **Select**. The following options are displayed.

Figure 7-41 View History Options

5) Select the test and date that you want to view from the appropriate drop-down list, then trackball to the **View** button and press **Select**. The relevant graphs are displayed showing activity over time in values of *Temperature*, *%*, or *Voltage*.

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7-3-10 H/W Report

The **H/W Report** button in the *FE Diagnostics* dialog box enables you to generate a report displaying the Front End boards, software versions and hardware revisions.

1) Access the *FE Diagnostics* dialog box, as described in the *Accessing the Front End Diagnostic Options* section, on page 7-6.

2) Trackball to the **H/W Report** button and press **Select**. The *System Report* window is displayed, as shown below:

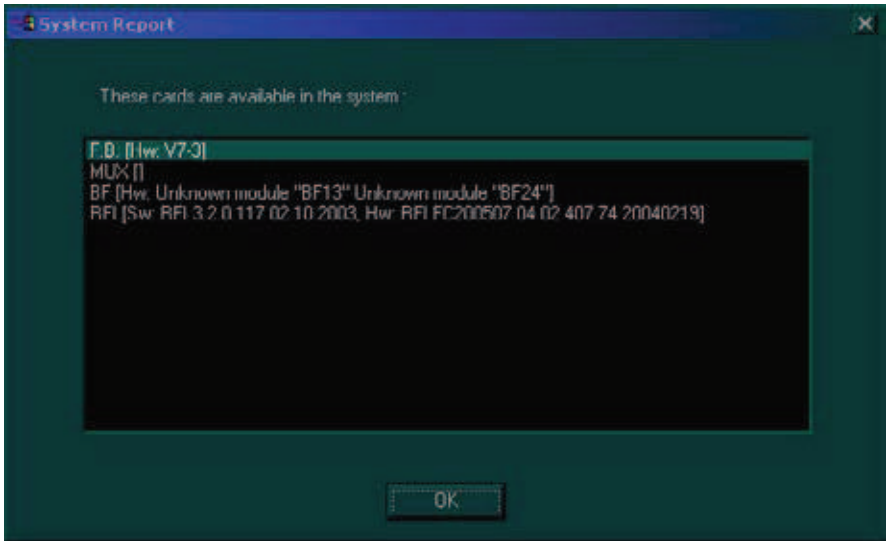
System Report
These cards are available in the system
F.E. [Hw: V7-3]
MUX []
BF [Hw: Unknown module "BF13" Unknown module "BF24"]
RFI [Sw: RFI 3.2.0.117 02.10.2003, Hw: RFI FC200507 04 02 407 74 20040219]
OK

Figure 7-42 System Report Window (RFI-configured Systems)

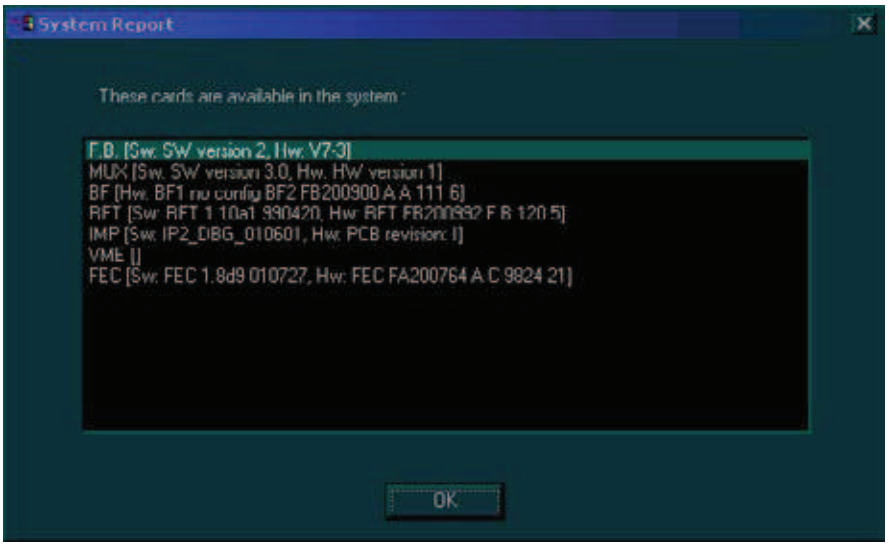
System Report
These cards are available in the system
F.E. [Sw: SW version 2, Hw: V7-3]
MUX [Sw: SW version 3.0, Hw: HW version 1]
BF [Hw: BF1 no config BF2 FB200900 A A 111 6]
RFT [Sw: RFT 1.10a1 990420, Hw: RFT FB200902 F B 120 5]
IMP [Sw: IP2_DBG_010601, Hw: PCB revision: I]
VME []
FEC [Sw: FEC 1.8d9 010727, Hw: FEC FA200764 A C 9824 21]
OK

Figure 7-43 System Report Window (RFT-configured Systems)

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7-3-11 Current Report

The **H/W Report** button in the *FE Diagnostics* dialog box enables you to generate a report of the current test and failure results.

1) Access the *FE Diagnostics* dialog box, as described in the *Accessing the Front End Diagnostic Options* section, on page 7-6.

2) Trackball to the **Current Report** button and press **Select**. The *Current Report* window is displayed, as shown below:

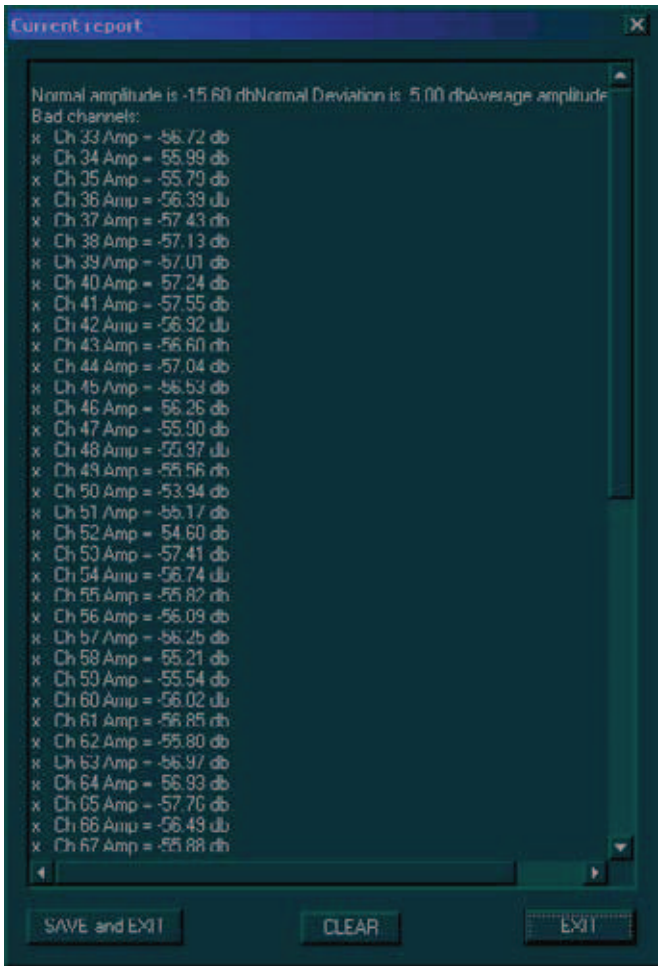
Current report
Normal amplitude is -15.60 dbNormal Deviation is 5.00 dbAverage amplitude
Bad channels:
x Ch 33 Amp = -56.72 db
x Ch 34 Amp = -55.99 db
x Ch 35 Amp = -55.79 db
x Ch 36 Amp = -56.39 db
x Ch 37 Amp = -57.43 db
x Ch 38 Amp = -57.13 db
x Ch 39 Amp = -57.01 db
x Ch 40 Amp = -57.24 db
x Ch 41 Amp = -57.55 db
x Ch 42 Amp = -56.92 db
x Ch 43 Amp = -56.60 db
x Ch 44 Amp = -57.04 db
x Ch 45 Amp = -56.53 db
x Ch 46 Amp = -56.26 db
x Ch 47 Amp = -55.90 db
x Ch 48 Amp = -55.97 db
x Ch 49 Amp = -55.56 db
x Ch 50 Amp = -53.94 db
x Ch 51 Amp = -55.17 db
x Ch 52 Amp = -54.60 db
x Ch 53 Amp = -57.41 db
x Ch 54 Amp = -56.74 db
x Ch 55 Amp = -55.82 db
x Ch 56 Amp = -56.09 db
x Ch 57 Amp = -56.25 db
x Ch 58 Amp = -55.21 db
x Ch 59 Amp = -55.54 db
x Ch 60 Amp = -56.02 db
x Ch 61 Amp = -56.85 db
x Ch 62 Amp = -55.80 db
x Ch 63 Amp = -56.97 db
x Ch 64 Amp = -56.93 db
x Ch 65 Amp = -57.76 db
x Ch 66 Amp = -56.49 db
x Ch 67 Amp = -55.88 db
SAVE and EXIT
CLEAR
EXIT

Figure 7-44 Current Report Window

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Section 7-4
Performing Back End Diagnostics on the System

The Back End Diagnostics enable you to test the functionality of various Back End hardware components.

Note: The Back End Diagnostic Tests may be performed independently, regardless of sequence.

7-4-1 Accessing the Back End Diagnostic Options

1) In 2D-Mode, press **<Ctrl+F11>** on the alphanumeric keyboard. The *Diagnostic* menu is displayed, as shown in Figure 7-1 on page 7-3.
2) In the *Diagnostic* menu, trackball to the **Back End** button and press **Select**. The *HW Diagnostics* menu is displayed, as shown below:

Figure 7-45 Back End Diagnostics Options

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Note: The following test options are available in the *HW Diagnostics* menu. These tests may be performed independently, regardless of sequence.

- **Audio:** Enables you to test the doppler sound, as described in the *Audio (Doppler Sound Driver) Diagnostic Test* section, on page 7-70.
- **ECG / Phono:** Enables you to test the ECG and Phono options, as described in the *ECG/ Phono Diagnostic Test* section, on page 7-71.
- **External Keyboard:** Enables you to test the keyboard options and lights in different modes, as described in the *External Keyboard Diagnostic Test* section, on page 7-73.
- **Keyboard:** Enables you to test the alphanumeric keyboard keys, as described in the *Keyboard Diagnostic Test* section, on page 7-76.
- **Media Driver:** Enables you to test the functionality of the media driver, if available, as described in the *Media Driver Diagnostic Test* section, on page 7-77.
- **Computer Testing:** Enables you to test the functionality of various modes, as described in the *Computer Diagnostic Test* section, on page 7-79.

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7-4-2 Audio (Doppler Sound Driver) Diagnostic Test

The audio test enables you to test the Doppler sound at different PRFs and frequencies.

1) Access the *HW Diagnostics* menu, as described in the *Accessing the Back End Diagnostic Options* section, on page 7-68.
2) Trackball to the **Audio** button and press **Select**. The *DopSound Driver Tester* dialog box is displayed, as shown below.

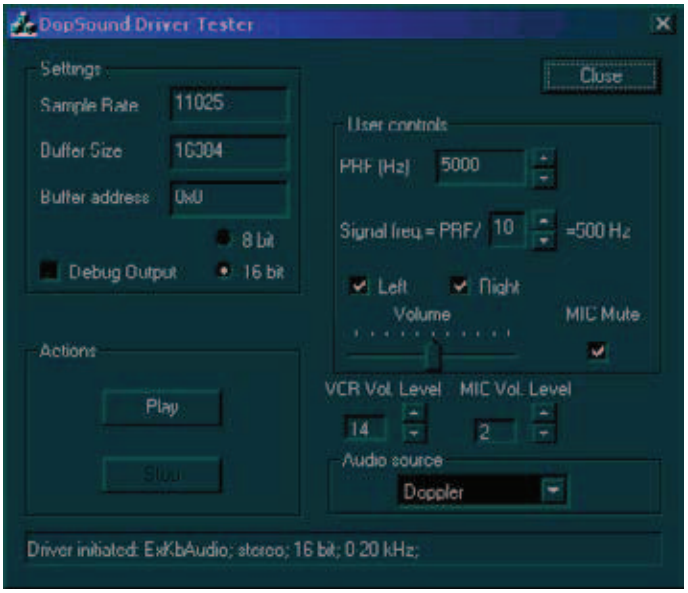

Figure 7-46 DopSound Driver Tester Dialog Box

Note: The audio tests are performed for each of the speakers, at various PRFs and frequencies. Left and right are as seen when standing behind the unit.

3) In the **User controls** area, trackball to the **Right** radio button and press **Select** to test the right speaker. Ensure that the left speaker is deselected.
4) In the **Actions** area, trackball to the **Play** button and press **Select**. Verify that a clear tone is emitted.
5) In the **User controls** area, change the PRF.
6) Trackball to the **Play** button in the **Actions** area and press **Select** to test the speaker activity at the new frequency. Verify that a clear tone is emitted.
7) Repeat steps 5 and 6 for the right speaker at a variety of frequencies.
8) Repeat steps 3 through 7 for the left speaker.
9) When you are finished, trackball to the **Close** button and press **Select**.

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7-4-3 ECG/Phono Diagnostic Test

The ECG and Phono tests enable you to check the output of the ECG and Phono options.

7-4-3-1 ECG Diagnostic Test

1) Connect the internal ECG input to yourself or to an appropriate ECG simulator, using the cable set and electrode pads.

Note: The external ECG can also be tested when the electrodes are connected to yourself or to an appropriate ECG simulator. In this case, select the **External ECG** radio button in the *TestECGDevice* dialog box.

2) Access the *HW Diagnostics* menu, as described in the *Accessing the Back End Diagnostic Options* section, on page 7-68.

3) Trackball to the **ECG / Phono** button and press **Select**. The *TestECGDevice* dialog box is displayed, as shown below:

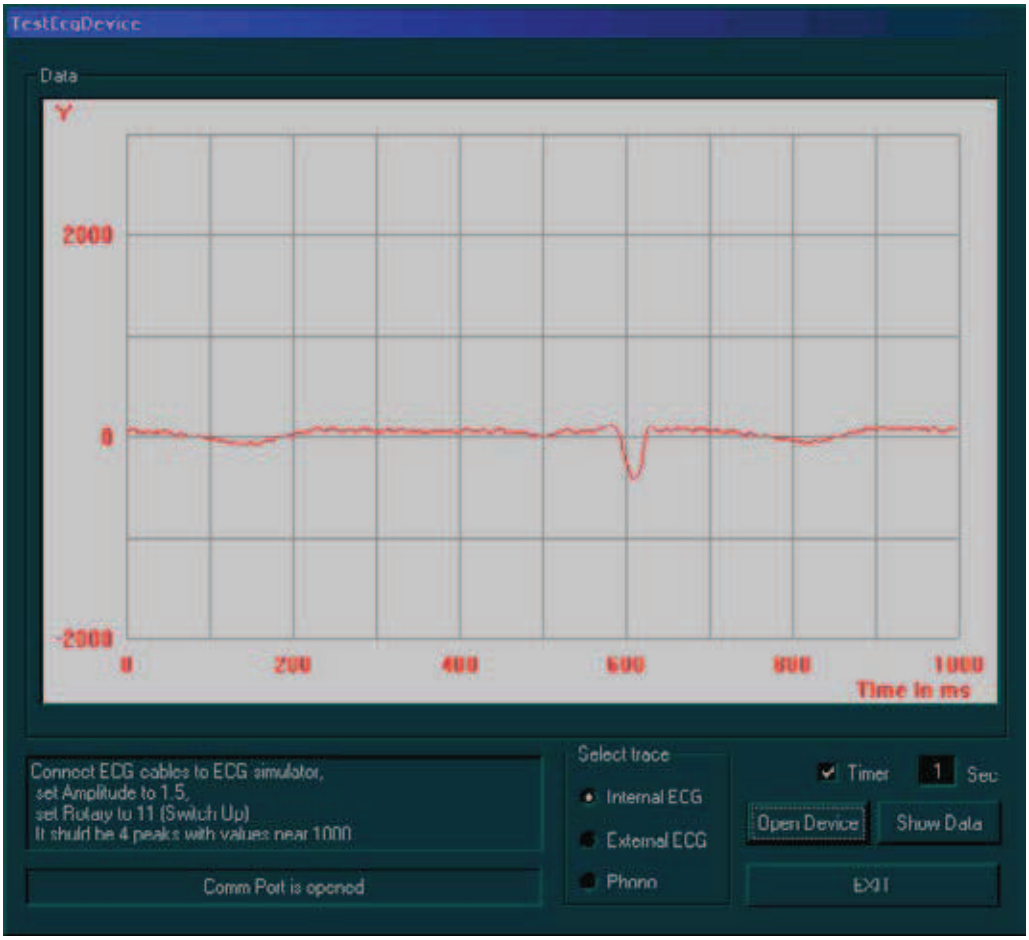

Figure 7-47 Test ECG Device Dialog Box

4) In the **Select trace** area, trackball to the **Internal ECG** radio button and press **Select**.

5) Trackball to the **Open Device** button and press **Select**. The ECG signal is displayed in the **Data** area. Verify that a single, clear QRS signal is displayed.

6) When you are finished, trackball to the **EXIT** button and press **Select**.

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7-4-3-2 Phono Test

1) Connect the media microphone to the microphone input on the ECG board.
2) Access the *HW Diagnostics* menu, as described in the *Accessing the Back End Diagnostic Options* section, on page 7-68.
3) Trackball to the **ECG / Phono** button and press **Select**. The *TestECGDevice* dialog box is displayed, as shown in Figure 7-47 on page 7-71.
4) In the **Select trace** area, trackball to the **Phono** radio button and press **Select**.
5) Trackball to the **Open Device** button and press **Select**.
6) Use your finger to click the microphone. The Phono signal is displayed in the data area. Verify that the waveform on the screen corresponds to the microphone clicks.
7) When you are finished, trackball to the **EXIT** button and press **Select**.

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